AD-A165 438 FLOOD EMERGENCY PLAN FOR MOUNT MORRIS DAM GENESEE RIVER WATERSHED NEW YORK VOLUME 2 APPENDIX A(U) CORPS OF ENGINEERS BUFFALO NY BUFFALO DISTRICT OCT 85 1/2

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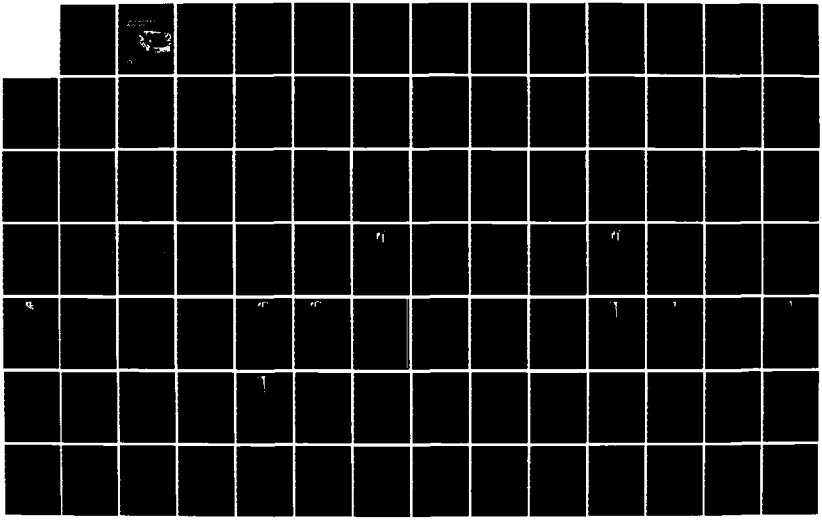

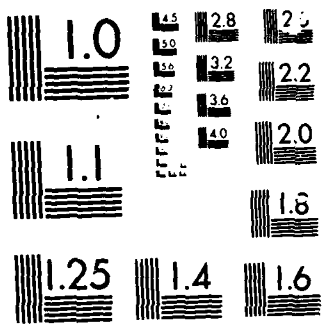

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Flood Emergency Plan

Mount Morris Dam

AD-A165 438

Genesee River Watershed

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REPORT DOCUMENTATION PAGE

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1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
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18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Flood Emergency Plan; Flood Hydrograph Package HEC-1; Unit Hydrographs; Thiessen Method; Snyder's Coefficients; Clark Method; Probable Maximum Precipitation (PMP); Probable Maximum Flood (PMF); Dam Failure Analysis; Breach Parameters; Outflow Hydrographs; Discharge Hydrographs; Stage Hydrographs; Discharge Rating Curve; Flooded Area Maps

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)
The two volume report provides the flood emergency plan for Mount Morris Dam. This document, Volume 2 contains one Appendix (A). Appendix A (Hydrology and Hydraulics) presents the PMF, evaluates two failure conditions (PMF with dam failure; dam failure at full pool) and a non-failure condition (PMF without dam failure), and provides the flood profiles and inundation (flooded area) maps showing the PMF from the dam to Lake Ontario.

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NCDED-W (NCBED-DM/12 Nov 85) 1st End   Mr. Vento/lj/353-6348
SUBJECT: Flood Emergency Plan, Mount Morris Dam

DA, North Central Division, Corps of Engineers, 536 South Clark Street, Chicago, Illinois 60605-1592 DEC 1985

TO: Commander, Buffalo District, ATTN: NCBED-DM

The revised plan, enclosed with the basic letter, adequately addresses the previous NCD comments. The emergency plan is approved. You are reminded to encourage local officials to proceed with the evacuation planning effort. A copy of your coordination letter to the local entities should be forwarded to NCDED-W.

FOR THE COMMANDER:

wd all encl

for ZANE M. GOODWIN, P.E.
Chief, Engineering Division

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DEPARTMENT OF THE ARMY
BUFFALO DISTRICT, CORPS OF ENGINEERS
1776 NIAGARA STREET
BUFFALO, NEW YORK 14207

NCBED-DM

12 NOV 1985

SUBJECT: Flood Emergency Plan, Mount Morris Dam

Commander, North Central Division
ATTN: NCDED-W

1. Enclosed are five copies of the report entitled "Flood Emergency Plan, Mount Morris Dam", in two volumes dated October 1985. Volume 1 consists of the Main Report; Appendix B ("Emergency Identification Subplan"), prepared in 1984 and revised in 1985; Appendix C ("Emergency Operations and Repair Subplan"), prepared in 1984 and revised in 1985; and Appendix D ("Notification Subplan"), prepared and revised in 1985. Volume 2 consists of Appendix A ("Hydrology and Hydraulics"), prepared in 1980 and revised in 1984.

2. Request approval of the enclosed report. Upon your approval, copies will be appropriately distributed.

3. My point of contact pertaining to this matter is Mr. Peter Kuszczak, P.E. of my O&M Support Section who can be contacted at commercial number 716-876-5454, extension 2231 or FTS 473-2231.

4. The Buffalo District -- Leadership in Engineering.

Bruce W. Haight LTC, CE
DANIEL R. CLARK,
Colonel, Corps of Engineers
District Commander

1 Enclosure (Quint)
as stated

FLOOD EMERGENCY PLAN FOR
MOUNT MORRIS DAM

GENESEE RIVER WATERSHED, NEW YORK

1980
Revised 1984

APPENDIX A

HYDROLOGY

AND

HYDRAULICS

U.S. Army Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

PREFACE TO APPENDIX A (Revised 1984)

This hydrologic/hydraulic analysis, designated as Appendix A for the Flood Emergency Plan, had been authorized by ER 1110-2-1451 (10 August 1978), ER 1130-2-419 (18 May 1978), and the "Flood Emergency Plan - Guidelines for Corps Dams" (June 1980). Appendix A was forwarded in March 1981 to North Central Division (ATTN: NCDED-W) for review, with the intention that it became an appendix to the overall Flood Emergency Plan for Mount Morris Dam. The analysis was approved in June 1981. North Central Division indicated that the plan should be prepared according to ER 1130-2-419 and the "Flood Emergency Plans, Guidelines for Corps Dams."

Since the transmittal and approval, several items discussed in the 1980 appendix have developed further. These items are supplemented in this preface bringing the appendix up to date (1984). The basic content of the appendix has not been changed; neither the conclusions nor the results of PMF Analysis and extent of flooded areas have been altered. The status of the debris problem and debris boom, plus the status of the stability analysis have progressed since 1980.

Paragraphs A3.33 to A3.43, plus A5.3, pertaining to the debris and debris boom, are discussed first. As stated in the 1980 appendix, no satisfactory solution to the debris problem had been developed up to 1980. After 1980, the Buffalo District conducted further investigations resulting in the 1982 completion of a 1,500-foot log boom which should adequately retain debris from passing over the spillway. Since the boom has become a workable solution to the debris problem, the operation of the dam is not as restricted as previously in preventing overtopping.

Paragraphs A3.25 and A5.2, pertaining to stability analysis and the effect of the PMF hydraulics on the dam, are discussed next. A boring program, completed in February 1984 by Mobile District, was performed to obtain parameters for the sliding stability analysis at different interfaces - concrete/rock and rock/rock. The Ohio River Division Laboratory has tested the rock cores obtained from the boring program. The Waterways Experiment Station has performed seismic stability analysis of the dam and reservoir rock slopes. Due to be completed in FY 86, the stability analysis (based on current design guidance, new design parameters, seismic analysis, and hydraulic/hydrologic study results) will require the evaluation of several modes of failure, including shear failure, sliding stability, reservoir wall stability, and seismic stability.

Typographical errors, omissions, and miscellaneous errors in Appendix A were found and subsequently corrected. An "at" sign, @, has be provided where these corrections were made. A label, "Revised 1984," has been placed on the pages that were revised or corrected.

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FLOOD EMERGENCY PLAN FOR
MOUNT MORRIS DAM

APPENDIX A

HYDROLOGY AND HYDRAULICS

A1. INTRODUCTION

A1.1 Authority

The hydraulic and hydrologic investigations presented are authorized and required by ER 1110-2-1451 1/ and ER 1130-2-419. 2/

A1.2 Purpose and Scope

The purpose of this report is to present the information required by the above regulations with respect to Mt. Morris Dam, operated and maintained by the Corps of Engineers, Buffalo District. Since the hydraulic and hydrologic determinations needed to comply with the regulations are complementary, the results of both are presented in this report. In Section A2 the location and physical components of Mt. Morris Dam, along with general watershed characteristics, are described. In Section A3 the hydrologic investigations of the spillway adequacy and potential hazards of spillway discharge are presented. The probable maximum flood (PMF) for "with" and "without" project conditions was determined based upon current criteria. The hazard associated with debris-laden spillway flows was identified with possible solutions presented. Section A4 presents the hydraulic effects of the structural failure of the dam. References cited throughout this appendix are presented in Section A6.

A2. WATERSHED AND PROJECT DESCRIPTION

A2.1 Description of Genesee River Basin

The Genesee River rises in the Allegheny Mountains, in Potter County, PA, and flows generally north for about 157 river miles to empty into Lake Ontario at Rochester Harbor, NY. The basin is about 100 miles long and has a maximum width of about 40 miles, as shown on Plate A1. The total basin area is 2,466 square miles, of which 1,075 square miles are above the dam. The largest tributary of the Genesee River is Canaseraga Creek, with a drainage area of 335 square miles. It joins the main stem about 4 miles below the dam site. The topography of the southern portion of the basin, above the dam, is steep and rugged, while the lower portion of the basin is gently rolling. The river drops from about elevation 1,080 feet to 768 feet over the three Portage Falls in Letchworth Park at the head of the reservoir area, flowing through deep gorges cut in the Portage formations. It then flows through narrow valleys and gorges to enter the broad lower Genesee Valley at Mt. Morris. From this point to Rochester, and along Canaseraga Creek below Groveland Station, the valleys are flat alluvial plains up to 3 miles in

1/ See Section A6 REFERENCES @

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width and formerly subject to frequent flooding. At Rochester, the river drops over three falls from elevation 481 to 249 feet and then empties into Lake Ontario. Numerous stream and lake stage gages are located throughout the basin and are shown on Plate A2.

A2.2 Description of Mt. Morris Dam

Authorized in 1944, completed in 1951, and first used for flood regulation on November 24, 1951, Mt. Morris Dam is located approximately 67 river miles above the mouth of the Genesee River in Livingston County, NY, and about 4 miles west of the village of Mt. Morris, and is shown on Plate A1.

A2.3 Mt. Morris Dam is a concrete gravity dam whose primary purpose is reduction of flood damage in the lower Genesee River. The overall length of the dam is 1,028 feet, with a top width of 20 feet, bottom width of 212.8 feet, and maximum height above the streambed of 215 feet. The uncontrolled ogee overflow spillway, 550 feet long, is located in the center of the dam with a crest elevation of 760 feet msl. Nine rectangular outlet conduits with a 5 x 7 foot minimum cross section are located at the base of the spillway section. A concrete stilling basin containing two rows of baffle blocks near the downstream end serves both the spillway discharge and the outlet conduits. The cross sectional shape is roughly trapezoidal with partially stepped sides. Further description of the project may be found in the Reservoir Regulation Manual. [3] The plan, elevation, and typical sections of the dam are presented on Plates A3 and A4.

A2.4 Description of Mt. Morris Reservoir

The Mt. Morris Reservoir is contained entirely in the deep and narrow valley of the Genesee River between Mt. Morris and the lower Portage Falls. Below the falls, the river flows through a constricted valley for 1.5 miles, thence through a narrow canyon over 500 feet deep and 3 miles long known as the Portage High Banks. The next 5 miles is through the narrow St. Helena Valley and thence through another gorge section, known as Mt. Morris Canyon, for 7 miles to the dam. At the top of flood control pool, elevation 760 feet, the reservoir has a total length of about 17 miles and a maximum width of about 1/2-mile. The total storage at top of flood control pool is 337,400 acre-feet, of which 610 acre-feet is dead storage. The area at full pool is 3,300 acres. The reservoir area is rugged and undeveloped, and about 50 percent wooded.

A3. HYDROLOGIC INVESTIGATION OF SPILLWAY ADEQUACY

A3.1 General

The construction and operation of a dam and spillway may create or aggravate a potential hazard downstream of the spillway. In order to assure that the risk to non-Federal interests does not exceed the risk under conditions that would prevail without the project, the probable maximum flood for "with" and "without" dam conditions was modelled. The investigation was carried downstream until flood conditions under project conditions were equal to or less than those experienced under natural conditions.

A3.2 Unit Hydrographs

The computer program Flood Hydrograph Package HEC-1 4/ was used to develop the unit hydrographs utilizing the Clark and Snyder method. Unit hydrographs were developed for the Genesee River at Portageville, the local area between Portageville and the site of the dam (assuming dam nonexistent), Genesee River inflow to Mt. Morris Dam, and Canaseraga Creek inflow above Shakers Crossing. The derivation of these unit hydrographs is discussed in subsequent paragraphs.

A3.3 Storms used in a unit hydrograph determination should have a rainfall excess greater than 1 inch with the duration of rainfall excess approximately equal to or greater than the time of concentration of the watershed. Storms of November 1950 and April 1961, which did not meet these criteria, were the best then available for previous unit hydrographs 5/ derived for the Genesee River at Portageville. They underestimated peak discharge, since the duration of rainfall for the storms was significantly less than the time of concentration. The 28-29 September 1967 rainfall event was the only storm which fit the above criteria. (For the larger June 1972 storm, the Portageville gage was inoperative.) The basin average precipitation of 4.28 inches of which 1.56 inches was excess, was determined using the Thiessen Method. Thirteen nonrecording and five recording rainfall stations were used. Tables A3.1 and A3.2 present the rainfall and Thiessen weights for the stations. On Plate A5, the basin average hyetograph and observed discharge hydrograph are presented. The computed hydrograph for this event is also presented for comparison along with the derived unit hydrograph parameters and basin loss rates. On Plate A6, the 3-hour unit hydrograph for the Genesee River at Portageville is presented along with the time-area curve used.

Table A3.1 - Total Station Rainfall and Weight for September 1967 Storm Above Portageville

Station	Rainfall - Inches	Thiessen Weight
Alfred	1.36	0.061
Angelica	4.99	0.183
Bolivar	5.08	0.011
Franklinville	4.21	0.002
Friendship	6.65	0.052
Hornell-Almond	2.65	0.008
Portageville	4.82	0.039
Raymond	3.05	0.071
Rushford	5.52	0.143
Warsaw	4.22	0.072
Wellsville	3.34	0.124
Whitesville	2.22	0.091
Wiscoy	5.67	0.143

Table A3.2 - Recording Precipitation Station Weights - September 1967 Storm Above Portageville

Station	Thiessen Weight
Bolivar	0.185
Hornell-Almond	0.177
Mt. Morris	0.197
Raymond	0.107
Wellsville	0.334

A3.4 Snyder's method was used to develop the local area runoff between Portageville and the site of the Mt. Morris Dam for "without" dam conditions. Snyder's regional coefficients, C_t and C_p, developed for the Genesee River at Portageville, were assumed applicable. Table A3.3 presents the appropriate coefficient and basin parameters used to develop the 2-hour local area unit hydrograph utilizing the HEC-1 [4/] synthetic time-area curve.

Table A3.3 - Snyder's Coefficients and Local Area Basin Characteristics

Coefficient	Value
D.A.	93 sq. mi.
C_p	0.82
C_t	1.84
L	20.0 miles
L_{CA}	8.1 miles

The resulting 2-hour unit hydrograph may be found on Plate A7.

A3.5 Two storms, September 1967 and June 1972, were used to derive the inflow unit hydrograph to Mt. Morris Dam. A basin average precipitation of 4.29 inches fell during the 28-29 September 1967 storm with most of the rain falling within a 24-hour period. The rainfall excess for this storm was 1.55 inches, which produced an inflow flood hydrograph with a peak discharge of 42,500 cfs. The inflow flood hydrograph to the dam was determined by a reverse storage routing of the outflow. The basin average hyetograph and observed discharge hydrograph are presented on Plate A8.

A3.6 Fifteen daily and five hourly recording precipitation stations were used to develop the total basin average rainfall and temporal distribution for the September 1967 storm by the Thiessen Method. Tables A3.4 and A3.5 present the rainfall and Thiessen weights for the stations.

Table A3.4 - Total Station Rainfall and Weight for 1967 Storm Above Mt. Morris Dam

Station	Rainfall - Inches	Thiessen Weight
Alfred	1.36	0.058
Angelica	4.99	0.174
Bolivar	5.08	0.011
Franklinville	4.21	0.002
Friendship	6.65	0.050
Hornell-Almond	2.65	0.007
Mt. Morris	4.82	0.042
Portageville	3.05	0.047
Raymond	5.52	0.067
Rushford	3.73	0.134
Scio	4.22	0.038
Warsaw	3.34	0.069
Wellsville	2.22	0.079
Whitesville	5.67	0.086
Wiscoy	4.43	0.136

Table A3.5 - Recording Precipitation Station Weights for 1967 Storm Above Mt. Morris Dam

Station	Thiessen Weight
Bolivar	0.168
Hornell-Almond	0.162
Mt. Morris	0.267
Raymond	0.098
Wellsville	0.305

A3.7 The time-area curve used in the calculation of the unit hydrograph by the Clark method is presented in Table A3.6. On Plate A12 the resulting 3-hour inflow unit hydrograph is presented. The computed hydrograph for the September 1967 flood using the derived unit hydrograph is plotted with the observed hydrograph on Plate A8 along with the derived unit hydrograph parameters and basin loss rates.

Table A3.6 - Time-Area Curve for Mt. Morris Dam

Time (Percent)	Area (Miles^2)
0	79.2
10	107
20	135
30	193
40	310
50	453
60	585
70	725
80	840
90	955
100	1,075

A3.8 Tropical Storm Agnes, June 1972, produced the most destructive, widespread flooding of record over the eastern United States. In the Genesee River Basin, the major portion of the rainfall occurred from 9:00 p.m., 20 June, to 6:00 a.m., 23 June. The average total basin rainfall for the period 20-25 June for the upper basin (above Mt. Morris Dam) was 10.20 inches. Regulation during a portion of this flood required a controlled release of dam outflows in excess of downstream channel capacity to prevent overtopping the spillway with debris-laden flows. The reservoir pool reached a maximum elevation of 755.8 feet, which is approximately 96 percent of total reservoir storage. On Plate A9, the inflow/outflow discharge hydrograph and resulting storage are presented. Inflows were determined by a reverse storage routing.

A3.9 The inflow hydrograph for Agnes was subdivided into two hydrographs which are shown on Plate A10. Difficulty in reconstituting the first portion of Agnes, designated H_1, could not be resolved and a unit hydrograph was derived only for the second portion of Agnes, designated H_2. Ten total rainfall stations were used to develop the average total basin

rainfall and are presented in Table A3.7. The recording precipitation stations and time-area curve used may be found in Tables A3.5 and A3.6. The observed rainfall and discharge hydrograph are shown on Plate A11 along with the hydrograph computed using the derived Clark unit hydrograph parameters and basin loss rates. The unit hydrograph is found on Plate A12.

Table A3.7 - Total Station Rainfall and Weight for Second Portion of June 1972 Storm, H_2, Above Mt. Morris Dam

Station	Rainfall - Inches	Thiessen Weight
Warsaw	4.5	.05
Mt. Morris	3.7	.02
Portageville	3.7	.10
Wiscoy	5.11	.12
Rushford	3.2	.12
Angelica	5.65	.18
Scio	2.8	.14
Wellsville	4.83	.09
Whitesville	5.34	.11
Raymond	4.75	.07

A3.10 Using the 3-hour unit hydrographs derived from the September 1967 and the June 1972 floods, a composite unit hydrograph was computed by averaging discharge ordinates. The composite 3-hour inflow unit hydrograph to Mt. Morris Dam is shown on Plate A12.

A3.11 The downstream reach of Canaseraga Creek below Dansville is characterized as a channel with minimal capacity and an extremely wide, flat, flood plain. During a flood, considerable overbank storage occurs, with the outflow from Canaseraga Creek at Shakers Crossing dependent upon the fall between Shakers Crossing and the Genesee River. An inflow hydrograph above Shakers Crossing for the April 1961 flood was derived by routing and combining flood hydrographs for Keshequa Creek at Sonyea, Canaseraga Creek at Dansville, and local area runoff. The resulting April 1961 inflow flood hydrograph to Shakers Crossing is shown on Plate A13. Six total and two recording rainfall stations were used to calculate the basin average precipitation and temporal distribution using the Thiessen method. Tables A3.8 and A3.9 present the rainfall and Thiessen weights for the stations.

Table A3.8 - Total Station Rainfall and Weight for April 1961 Storm for the Canaseraga Creek Basin

Station	Rainfall - Inches	Thiessen Weight
Dansville	2.61	.276
Groveland	2.02	.188
Haskinville	3.89	.038
Hornell-Almond	1.59	.143
Mt. Morris	1.85	.104
Portageville	2.18	.251

Table A3.9 - Recording Precipitation Station Weights - April 1961 Storm for the Canaseraga Creek Basin

Station	Thiessen Weight
Hornell-Almond	.5
Mt. Morris	.5

A3.12 The basin average precipitation for the Canaseraga Creek basin during the April 1961 storm was 2.21 inches (1.32-inch excess) with most of the rain falling in an 18-hour period. Plate A14 shows the resulting 2-hour inflow unit hydrograph for Canaseraga Creek above Shakers Crossing, along with the time-area curve used. The computed hydrograph for the event is plotted with the observed hydrograph for comparison on Plate A13, along with the derived unit hydrograph parameters and basin loss rates.

A3.13 Probable Maximum Precipitation for Genesee River Basin

Probable Maximum Precipitation (PMP) estimates were made for the Genesee River basin utilizing the all-season regional maps presented in HMR-51[6/]. The resulting depth-area-duration curves are shown on Plate A15, and serve as the basis of the calculation of the PMP at the various areas under investigation. The isohyet pattern presented in CW52-8[7/] was used to calculate the basin average PMP. The isohyetal pattern is a depth-area relation for a 96-hour rainfall duration expressed as a percentage of the index rainfall. The pattern was centered over the drainage area above Mt. Morris Dam and oriented in such a manner as to maximize the total rainfall. The isohyetal pattern is shown on Plate A16.

A3.14 Probable Maximum Flood Without the Dam

In order to develop the Probable Maximum Flood (PMF) hydrograph at the site of the Mt. Morris Dam without the structure in place, the PMF for the Genesee River at Portageville was routed to the site of the dam and combined with the PMF contribution of the local area runoff. The PMF at the site of the dam was then routed and combined with Canaseraga Creek, resulting in the PMF for the Genesee River at Jones Bridge. In the calculation of the PMF hydrographs, 0.5 inch initial and 0.05 inch/hour uniform basin loss rates were assumed. The loss rates were determined by reviewing loss rates from large historic floods and those used in previous reports.

A3.15 The basin average PMP contribution to the Genesee River basin above Portageville was determined using the isohyetal pattern presented on Plate A16 with an index PMP of 22.0 inches. Table A3.10 presents the calculation of the 23.2 inch PMP contribution above Portageville. Applying the PMP above Portageville with the loss rates explained in A3.14 to the Portageville 3-hour unit hydrograph shown on Plate A6 resulted in a PMF peak discharge of 440,000 cfs at Portageville. On Plate A17 the PMP hyetograph and PMF hydrograph at Portageville is presented.

Table A3.10 - Subarea PMP Above Portageville, NY

Isohyet	96-Hour Mean Depth-Inches	Area - Mi^2	Volume - Mi^2 In.
140	30.8	9.52	293.22
140-130	29.7	23.19	688.74
130-120	27.5	72.10	1,982.75
120-110	25.3	203.55	5,149.82
110-100	23.1	307.05	7,092.86
100-90	20.9	311.81	6,516.83
90-80	18.7	53.78	1,005.69
		981.	22,729.91

PMP = (22,729.91)/981. = 23.2 inches @

A3.16 The Muskingum routing criteria from Portageville to the site of the Mt. Morris Dam was determined as follows. From the time of flood peaks for historic events, an average travel time of 6 hours from Portageville to the site of the dam was determined. The reach between Portageville and the site of the dam is characterized as a steep-walled narrow gage indicating a Muskingum attenuation coefficient, x, of 0.4. The PMF at Portageville routed to the site of the Mt. Morris Dam may be found on Plate A18A.

A3.17 The PMP contribution over the local area between Portageville and the site of the dam was determined by the isohyet method using the pattern shown on Plate A16. Table A3.11 presents the calculation of the 18.2 inch PMP contribution over the local area. Applying the PMP with the loss rates explained in A3.14 to the local area 2-hour unit hydrograph shown on Plate A7 resulted in a peak discharge of 58,400 cfs. On Plate A18 the PMP hyetograph and PMF hydrograph for the local area between Portageville and the site of the dam is presented.

Table A3.11 - Subarea PMP for Local Area

Isohyet	Mean Depth - In.	Area - Sq. Mi.	Volume - Mi^2 In.
100-90	20.9	5.97	124.77
90-80	18.7	62.33	1,171.18
<80	16.5	25.40	420.09
		Total 94.	1,716.04

PMP = (1,716.04)/(94) = 18.2 Inches @

A3.18 Combining the local inflow and Portageville routed hydrograph resulted in the PMF at the site of the Mt. Morris Dam without the structure, as shown on Plate A18A. Table A3.12 presents peak discharges for floods with various proportions of the PMF at the site of Mt. Morris Dam.

Table A3.12 - Ratios of the PMF at Site of Mt. Morris Dam Without Structure

Proportion of PMF	PMF at Portageville - cfs	PMF : Local Area - cfs	Local Contribution to Peak - cfs	PMF at Dam Site W/O Dam - cfs
0.2	88,000	11,700	142	86,700
0.4	176,000	23,400	283	173,000
0.6	264,000	35,000	425	260,000
0.8	352,000	46,700	567	347,000
1.0	440,000	58,400	709	433,000

A3.19 Downstream of the site of the Mt. Morris Dam a major tributary, Canaseraga Creek, enters the Genesee River. The basin average PMP contribution to the Canaseraga Creek basin was determined using the isohyetal pattern shown on Plate A16. Table A3.13 presents the calculation of the 17.3 inch PMP. Applying the PMP to the 2-hour inflow unit hydrograph above Shakers

Crossing resulted in an inflow PMF peak discharge of 160,000 cfs. On Plate A19 the PMP hyetograph and inflow PMF hydrograph above Shakers Crossing is presented.

Table A3.13 - Subarea PMP Over Canaseraga Creek

Isohyet	Mean Depth - Inches	Area - Sq. Mi.	Volume Mi^2 - Inches
100-90	20.9	5.94	124.15
90-80	18.7	108.40	2,027.08
<80	16.5	218.66	3,607.89
		Total 333	5,759.12

PMP = (5,759.12)/(333) = 17.3 Inches @

A3.20 During flooding, the outflow from Canaseraga Creek is dependent upon its upstream conditions, lateral inflow along its reach, and the water surface elevation at the confluence with the Genesee River. This presented an interesting problem as traditional hydrologic routing and combining methods will not adequately model this type of junction. For this problem, the hydraulic routing capability of the National Weather Service dam break computer program, DAMBRK[8/], was utilized to route and combine the PMF to Jones Bridge. The program performs the routing via an implicit finite difference solution of the complete one-dimensional equations of unsteady flow (St. Venant equations). Since the DAMBRK program is a one-dimensional unsteady flow model and because of the interdependance of the flows in the Genesee River and Canaseraga Creek, an iterative procedure was necessary to properly model the junction. This was accomplished by successively considering the main stem and then the tributary as a point source. Convergence was obtained when the hydrograph at Jones Bridge was within a suitable tolerance. Plate A20 shows the outflow PMF hydrograph for Canaseraga Creek at Shakers Crossing. Negative discharges represent Genesee River flow into Canaseraga Creek storage.

A3.21 Probable Maximum Flood With Dam - Previous Analyses

The original SDF for Mt. Morris Dam was based on envelope curves for the 31 August - 1 September 1914 storm in Michigan, increased by 25 percent. The 17-inch rainfall in 48 hours was assumed to fall on wet soil with infiltration losses taken as 0.05 inches/hour. A peak inflow to the reservoir of 330,000 cfs resulted by arranging the 6-hour rainfall increments to produce a maximum value. With the reservoir pool initially at the spillway crest, elevation 760 feet, and all outlets blocked, the routing computations indicated a maximum spillway discharge of 320,000 cfs. A surcharge height of 28 feet was produced, bringing the reservoir pool to an elevation of 788 feet and a required elevation of the nonoverflow sections at 789.65 feet USC&GS. The SDF hydrograph may be found on Plate A21.

A3.22 In response to EC 1110-2-34 dated 1 November 1966, the spillway adequacy and freeboard allowances at Mt. Morris Dam were determined and presented in a Summary Report [9]. The SDF was based on PMP estimates from HMR-33[10]. With the reservoir pool initially full and the conduits assumed inoperative, the maximum spillway discharge was 362,000 cfs. The required elevation for the nonoverflow section would be 790.5 feet USC&GS, which is one-half foot higher than the existing structure. It was concluded that based on the updated SDF, the spillway adequacy and freeboard allowance at Mt. Morris Dam were not wholly adequate, but the safety of the facility was not compromised. The outflow PMF hydrograph for the 1967 analysis may be found on Plate A21.

A3.23 Probable Maximum Flood With Dam - Present Analysis

The PMP above the Mt. Morris Dam for the current investigation was determined using the isohyet method and Plate A16 with the calculation shown in Table A3.14. Usage of the 22.7 inch PMP with the loss rates explained in A3.14 applied to the composite inflow unit hydrograph on Plate A12 resulted in an inflow peak discharge of 442,000 cfs as shown on Plate A24.

Table A3.14 - PMP Above Mt. Morris Dam

Isohyet	Mean Depth - Inches	Area - Sq. Mi.	Volume - Mi^2 Inches
>140	30.8	9.53	293.52
140-130	29.7	23.21	689.34
130-120	27.5	72.18	1,984.95
120-110	25.3	203.76	5,155.13
110-100	23.1	307.36	7,100.02
100-90	20.9	317.77	6,641.39
90-80	18.7	116.13	2,171.63
<80	16.5	25.06	413.49
		Total 1,075.00	24,449.47

PMP = (24,449.47)/(1,075) = 22.7 inches @

A3.24 The inflow PMF hydrograph was routed through the dam using the modified Puls method with a full pool initially and the conduits inoperative. The full pool condition (elevation 760 feet) accelerates the concentration of runoff under critical conditions. The elevation storage curve for Mt. Morris Dam is shown on Plate A22. The spillway rating curve presented in the Reservoir Regulation Manual[3] was extended and is shown on Plate A23. The spillway discharge coefficients used were developed during the hydraulic studies of the dam[11]. The discharge over the nonoverflow sections of the dam was determined using a broadcrested weir formula with a discharge

coefficient of 2.50. The outflow PMF hydrograph from the dam is shown on Plate A24. In Table A3.15 the discharge and reservoir information for ratios of the PMF for Mt. Morris Dam are shown.

Table A3.15 - Discharge and Reservoir Data for PMF: Mt. Morris Dam @

Ratio of PMF	Inflow - cfs	Outflow - cfs	Maximum Elevation - Ft.
0.2	89,000	83,000	772.4
0.4	178,000	172,000	779.4
0.6	267,000	262,000	784.9
0.8	356,000	352,000	789.7
1.0	445,000	442,000	793.8

A3.25 In Table A3.16 a comparison of present and past PMF analyses for the dam are presented with the hydrographs shown on Plate A21. The wave runup on the concrete wall sections was assumed the same as previously calculated. The major difference between the original SDF analysis and the 1967 investigation was the amount of precipitation used, whereas during the present analyses the major difference was in the unit hydrograph. As shown on Plate A24, the static pool elevation for the present PMF analysis is above the nonoverflow portion of the dam for one-half day. At present the Buffalo District is not considering structural modification of the Mt. Morris Dam. After the stability analysis utilizing the present PMF is completed, the effect of the present PMF on the dam will be assessed and the appropriate recommendations will be made.

Table A3.16 - Comparison of Present and Past PMF Analyses

	Original	1967	Present
Maximum Spillway Discharge - CFS	320,000	362,000	442,000
Maximum Reservoir Pool Surcharge Elevation, Feet USC&GS	788.	788.8	793.8
Runup Above FRL[a] Feet	1.65	1.65	1.65 @
Required Elevation of Nonoverflow Section,[b] Feet USC&GS	789.7	790.5	795.5

[a] Freeboard Reference Level

[b] Actual Nonoverflow Elevation = 790.0 Feet USC&GS

A3.26 As part of the Flood Emergency Plan for Mt. Morris, the flooded area due to the PMF was established. The hydraulic routing model used in the dam failure analysis described in Section A4 was used to route the PMF to

Rochester. On Plate A29 and Plates A34 through A46, the PMF discharge and stage hydrographs at various locations downstream of the Mt. Morris Dam are presented. The flood areas for the PMF are shown on Plates A47 through A52 and Plate A56. The maximum elevation and time to maximum elevation for the PMF are presented in Table A4.2.

A3.27 PMF at Mt. Morris Dam Based on HMR-52 Criteria

As part of the response to NCD's request for District review of HMR-52[12/], the Buffalo District indicated[13/] that it would also calculate the PMF for Mt. Morris Dam using the draft criteria. Utilizing the HMR-51[6/] PMP depth-duration relation, the resulting 6-hour PMP increments were arranged in descending order. The three greatest 6-hour PMP increments were reduced by 4 percent based upon a 62 degree difference between the rainfall and drainage orientation following Figure 10 in HMR-52.

A3.28 In order to determine the temporal distribution of the rainfall, HMR-52 suggests rules for arranging the four groups of three 6-hour rainfall increments. For the purposes of this report, these four groups are designated by a letter, with "A" representing the group of three greatest 6-hour PMP increments, "B" as the second largest group, etc. Following the temporal distribution criteria, it is possible to arrange the four rainfall groups into 10 different patterns. Two patterns, DBAC and DABC, were selected to determine hydrologically which was the most critical sequence.

A3.29 Utilizing Figures 16 through 18 of HMR-52, the isohyet values for the three greatest 6-hour increments (group A) were calculated. A uniform rainfall depth was assumed across the drainage for the remaining nine 6-hour PMP increments (groups B, C, and D). Elliptical patterns with shape ratios of 2:1 and 3:1 were developed and positioned over the basin and aligned with the drainage orientation of 153 degrees. From the placement of the isohyetal pattern on the drainage, the drainage average PMP was determined for the three greatest 6-hour increments (group A) with values beyond these unchanged. The isohyetal patterns with shape ratios of 2:1 and 3:1 may be found on Plates A25 and A26, respectively.

A3.30 The 3-hour inflow unit hydrograph to Mt. Morris Dam shown on Plate A12 was used in the calculation of the outflow PMF from the dam. With 3-hour rainfall increments used, it was necessary to decide on the rainfall distribution within the 6-hour amounts. Initially, the 6-hour PMP amounts were distributed equally to the 3-hour increments. After the most critical temporal distribution and shape ratio were determined, a test was made with the maximum 6-hour rainfall increment amount subdivided into two 3-hour increments containing 33 and 67 percent of the maximum 6-hour increment amount.

A3.31 Table A3.17 presents the PMF results using HMR-52 for various cases. Using a shape ratio of 3:1, the DBAC temporal distribution with the maximum 6-hour rainfall increment amount distributed equally into 3-hour interval amounts resulted in a maximum outflow PMF from Mt. Morris of 393,000 cfs as shown on Plate A27. This represents an 11.1 percent peak discharge reduction and 2.1 feet reduction in the maximum sucharge elevation in the Mt. Morris Reservoir compared to the present accepted PMF analysis discussed in

paragraphs A3.23 to A3.26. These reductions are mainly attributed to the orientation of the isohyetal pattern following HMR-52 (Draft) criteria. The major to minor axis ratio of the elliptical isohyetal pattern and the temporal rainfall distribution affected the basin average precipitation and peak discharge to a lesser extent. It is suggested that the orientation criteria presented in the HMR-52 draft report be considered for inclusion in the final report. Additional guidance should be given concerning the selection of the temporal precipitation distribution and eccentricity of the elliptical isohyetal pattern.

Table A3.17 - PMF Analyses Using HMR-52 (Draft) at Mt. Morris Dam

Shape Ratio	Temporal Distr.	Distr. of Max. 6-Hr. Rain	Rainfall Excess - In.	Peak Inflow - cfs	Peak Outflow - cfs	Max. Surcharge Elev - Ft.
2:1	DBAC	50/50	15.59	386,000	381,000	791.2
2:1	DABC	50/50	15.59	389,000	385,000	791.3
3:1	DBAC	50/50	15.86	394,000	388,000	791.4
*3:1	DABC	50/50	15.86	396,000	393,000	791.7
3:1	DABC	33/67	15.86	394,000	391,000	791.4
PMF-1980		33/67	19.11	445,000	442,000	793.8

*Maximum case of those tested using HMR-52 criteria.

A3.32 Comparison of PMF With and Without Mt. Morris Dam

At Mt. Morris Dam, the PMF discharge with and without the structure are essentially the same (2 percent difference), although the time of occurrence of the peak discharges differ by approximately 3 hours because the full reservoir pool accelerates the runoff. No real estate interest will be required downstream of Mt. Morris Dam in accordance with ER 1110-2-1451[1/] since the operation of the spillway does not increase the flood conditions. The with and without dam PMF hydrographs at the site of the Mt. Morris Dam are shown on Plate A28.

A3.33 Debris Problem

As indicated in Paragraph A3.32, the construction of Mt. Morris Dam has not increased flood conditions downstream of the dam. However, the Mt. Morris project has had a continuing problem with debris collecting at the dam. With the probability of spillway overtopping at 4 percent (1 in 25 years), [3/] the operation of the spillway will aggravate a potential hazard due to the debris movement within the downstream floodway. During Tropical Storm Agnes 1972, there was no means of retaining the debris, resulting in other measures being taken to prevent overtopping. Opening the gates more than the specified operation policy resulted in a "controlled" debris-free flood downstream of the dam. Overtopping may not necessarily be prevented at a future date by

increasing conduit outflows. Alternatives for dealing with this problem have been identified and will be discussed in subsequent paragraphs.

A3.34 In order to be able to properly evaluate the various alternatives, a preliminary assessment was made of the source, quantity, and quality of debris. A field investigation indicated that the majority of the debris has originated from flood plain areas inundated within the reservoir area. During periods of reservoir operation, the soil becomes saturated, preventing oxygen and carbon dioxide exchange with the tree root. Tree mortality results when inundation lasts from several hours to several days, depending on the sensitivity of the particular species. Within 5 to 10 years, the bark and branches are stripped off by the elements and microorganisms, leaving only the bare trunk. In time, the trunk will topple, waiting to be carried downstream during succeeding flood events. It was surmised that much of the debris and dead trees presently along the banks were due to Tropical Storm Agnes 1972, particularly at the higher elevations.

A3.35 Estimates for the total amount of debris within the reservoir pool area have not been made; however, estimates of debris accumulation at the face of the dam were available from removal operations and are given in Table A3.18. The recurrence of a major flood will cause a large amount of the upstream debris to be carried downstream to the dam.

Table A3.18 - Estimated Debris at Mt. Morris Dam

Year	Floatable Debris and Debris on Bank to Elev. 610 - Cu. Yd.	Nonfloatable Debris [a] Cu. Yd.
1976	12,000	4,500
1977	3,000	2,000
1978	11,100	2,300
1979	9,400	2,300
1980	5,400	3,000

[a] Considered as 30 percent of silt and nonfloatable debris

A3.36 Most of the debris are tree trunks and branches devoid of their bark in varying degrees of decay. Approximately 75-85 percent are deciduous and 15-25 percent coniferous. The deciduous trees consist of White Oak, Red Oak, Sugar Maple, Paper Birch, Yellow Birch, American Basswood, and Quaking Aspen.

A3.37 The District has considered four alternatives for solving the reservoir debris problem.

a. Do nothing.

b. Permanent low fence across spillway crest.

c. Some type of log boom system.

d. Clearing operation of debris within reservoir area.

At the present time the District does not have a workable solution to the debris problem. This means that during a major flood event, the debris could overtop the spillway and possibly add to downstream flooding and damage. In light of this problem, and of the guidance given in ER 1110-2-1451, [1/] the Do-Nothing solution is not acceptable and consideration is being given to other possible solutions listed above.

A3.38 The placement of a permanent low fence, about 5 feet high, has been considered. It was hoped that the debris could be screened off until a reservoir elevation was reached where downstream bridges would be washed out by overtopping flows. Despite the considerable thought given to this alternative, it will not solve the problem as it will have the equivalent effect of raising the spillway crest. During an overtopping event, debris will completely jam behind the fence, resulting in an increase in reservoir storage of only 0.3 inches. This additional storage would decrease the peak discharge and lag the timing of the peak. This effect will be minimal, however, and the debris will still overtop.

A3.39 Various permanent and temporary log boom arrangements have been suggested. A temporary retainment system would consist of maintaining a log boom along the side of the gorge and installing it only when an overtopping flood is anticipated. The debris could be corralled together by the log boom, or by tying the outer perimeter logs together with ropes and towing the debris upstream away from the dam and the spillway area. Upstream anchor points would be utilized as tie-off points. This alternative would require personnel to be in the reservoir during periods of high water and necessitates the storage of the boats at the dam on a continuous basis.

A3.40 Reinstallation of the original log boom system upstream of the dam, with a modification designed to decrease the breaks occurring in the chain by allowing the log links to rotate, has been suggested. Because of the draping effect, quantities of debris passed between the boom and the gorge walls in previous years. Further, pool level fluctuations caused the timber links to cling to the gorge wall, resulting in further retainment inefficiency.

A3.41 A log boom suspended by cables along the upstream face of the dam to be utilized only when overtopping is anticipated is another log boom system under consideration. The cables attached to each end of the log boom would be fastened to the top of the dam and then draped to the concrete anchor blocks embedded in the canyon walls. The cables would be attached to a winch, which would pull the debris away from the spillway during high pool. The suspended log boom would float up with the debris at the face of the dam when the pool elevation rises, and when overtopping is imminent the debris can be pulled upstream away from the spillway. Some sections of the original log boom can be utilized to cut installation costs.

A3.42 An alternative consisting of removing all dead and dying trees within the gorge below the spillway crest elevation, 760.0 feet, has also been suggested. As indicated in paragraph A3.34, the majority of the debris @ occurs within the reservoir pool area. The removal of this debris will not eliminate the annual collection of debris at the dam face, but will lessen the amount of debris passing over the spillway during an overtopping event. Environmentally this may be an unsound alternative, depending upon the amount of desecration of the landscape during the debris removal and the potential of the environment to heal itself. Monitoring of the removal activities will preclude needless destruction of the environment. This alternative also would include the temporary system described in Paragraph A3.39 with appropriate modifications as necessary. Annually, the boom would be used to corral the debris to a collection point, to be distributed by Letchworth State Park for firewood. This could be accomplished as early as possible during the period of operation for the scenic pool (15 June to 1 November). The boom would also be utilized during flood events which have a potential for overtopping the spillway.

A3.43 The Buffalo District is presently in contact with other districts and Federal agencies soliciting their views on the subject. Although no satisfactory solution has been developed at present, the District will conduct further investigations in constructing a log boom which will adequately retain debris from passing over the spillway during an overtopping event. Increasing conduit outflows above the presently prescribed operation policy worked during Tropical Storm Agnes. However, this resulted in a controlled flood due to the under-utilization of available flood control storage. Until the log boom solution becomes workable, the operation of the dam will be restricted to some degree to prevent overtopping of debris.

A4. DAM FAILURE ANALYSIS

A4.1 General

In accordance with "Flood Emergency Plans, Guidelines for Corps Dams," 14/ three conditions, including spillway design discharge without dam failure, spillway design discharge with dam failure, and dam failure at top of the flood control pool, were studied. The PMF without dam failure has been discussed in Section A3. The dam failure analysis was accomplishd utilizing the NWS Dam Break program, DAMBRK8/. The model consists of three functional parts, the temporal and geometrical description of the breach; the computation of the outflow hydrograph as affected by the breach description, reservoir inflow, reservoir storage characteristics, spillway outflows, and downstream tailwater elevations; and routing the outflow hydrograph downstream via an implicit finite difference solution of the St. Venant equations.

A4.2 PMF With Dam Failure

The selection of the breach parameters introduces a varying degree of uncertainty in the model results; however, errors in the breach description and the resulting time rate of volume outflow are rapidly dampened as the flood wave advances downstream. Concrete gravity dams tend to have a partial

breach as one or more monolith sections formed during the construction of the dam are forced apart by the escaping water[8]. The time for the breach to completely form ranges from 0.1 to 0.5 hours. [14] For conservative forecasts, the failure time should be selected in the lower range to produce a maximum outflow.

A4.3 In Table A4.1 the selected breach parameters for the failure of Mount Morris Dam during the PMF are presented. During the simulation of the dam failure, the actual breach formation was assumed to commence when the reservoir water surface elevation reached maximum pool in order to model the worst condition. The dam failure PMF discharge outflow hydrograph resulted in a peak discharge of 1,850,000 cfs and is shown on Plate A30.

Table A4.1 - Breach Parameters - Failure During PMF

Parameter	Value
Breach Width	150 Feet (3 Monoliths @ 50')
Side Slope of Breach	0:1 (Rectangular)
Failure Time	0.1 Hours
Failure Elevation	793.3 Feet (Maximum Pool)
Breach Bottom Elevation	580.0 Feet

A4.4 As indicated in paragraph A4.1, the DAMBRK program routes the @
failure hydrograph downstream via an implicit finite difference solution to the St. Venant equations. Since the peak discharge of dam break wave is considerably larger than runoff-generated flood waves, it is necessary to extrapolate certain coefficients and to make various assumptions concerning the effect of downstream bridges, dams, embankments, and tributaries. Although the coefficient of flow resistance, Manning's "n", has to be extrapolated beyond the range of past experience, the modification of the flood wave as it progresses downstream is usually not sensitive to "n." The effect of tributary inflows has been discussed in paragraph A3.20. Bridges are primarily @
designed to withstand vertical loading with nominal consideration given to horizontal forces perpendicular to the major axis except for wind pressures. Experience has shown that bridges normally wash out when overtopped with debris-laden flow. Highway/railway embankments located at points downstream may be treated as internal boundary conditions.

A4.5 The dam failure hydrograph was routed downstream to the Rochester gage. Throughout the routing computations, the effect of downstream dams, bridges, and highway embankments were neglected, as they would either fail long before the time of maximum elevation or they would have minimal effect upon the maximum water surface because of considerable submergence. Appropriate expansion-contraction coefficients were applied as necessary with Manning's "n" values ranging from 0.04 to 0.08. Downstream tributaries were treated as noneffective flow areas, which were considered to have storage but

Table A4.2 - Summary of Maximum Elevations, Velocities, Discharges, and Time to Maximum Elevations at Selected Locations

Location	River Mile*	Maximum Elevation-Feet: PMF W/O Failure	Maximum Elevation-Feet: PMF W/ Failure	Maximum Elevation-Feet: Failure at Full Pool	Time to Maximum Elev.-Hour: PMF W/O Failure	Time to Maximum Elev.-Hour: PMF W/ Failure	Time to Maximum Elev.-Hour: Failure at Full Pool
Town of Mt. Morris - Rt. 36	65.5	602.7	623.4	615.2	0.5	0.5	0.5
Junction - Canaseraga Creek	64.3	582.0	593.0	578.0	6.5	5.5	3.0
Gen. R. at Jones Bridge Gage	61.2	581.5	592.6	576.3	6.5	5.5	5.5
Gen. R. near Lucidol Plant	50.2	580.0	591.2	574.6	7.0	6.0	6.3
Gen. R. at Avon Gage	35.2	558.5	565.8	550.1	12.0	11.0	11.5
Gen. R. near Rush Rd.	23.6	554.8	561.2	546.6	14.0	13.5	14.4
Gen. R. at Browns Bridge Road (Rt. 253)	21.1	553.5	559.6	545.3	14.5	14.0	15.0
Gen. R. at Ballantyne Bridge Gage	14.3	547.8	552.2	537.1	18.0	17.5	22.0
Gen. R. at Rochester Airport	11.8	544.3	549.1	535.3	19.0	18.0	23.0
Gen. R. at Barge Canal Crossing	11.3	543.1	547.6	534.5	19.0	18.0	23.0
Gen. R. near Univ. of Rochester	9.9	534.8	538.3	527.9	19.5	18.0	23.4
Gen. R. at Court St.	8.1	523.6	527.1	519.0	20.0	18.5	24.0
Gen. R. at Central Ave.	7.4	503.2	507.0	494.4	20.0	18.5	24.0
Gen. R. at Rochester Gage	6.1	280.6	286.4	271.5	20.0	18.5	24.0

* River Mile: Distance along stream channel from mouth in miles. Mt. Morris Dam located at River Mile 66.9.

Table A4.2 - Summary of Maximum Elevations, Velocities, Discharges, and Time to Maximum Elevations at Selected Locations (Cont'd)

Location	Maximum Velocity-MPH PMF W/O Failure	PMF W/ Failure	Failure at Full Pool	Maximum Discharge-CFS PMF W/O Failure	PMF W/ Failure	Failure at Full Pool
Town of Mt. Morris - Rt. 36	13.4	19.3	17.5	440,000	1,430,000	1,050,000
Junction - Canaseraga Creek	1.2	2.8	4.4	465,000	1,300,000	921,000
Gen. R. at Jones Bridge Gage	1.4	2.4	2.7	446,000	1,010,000	647,000
Gen. R. near Lucidol Plant	1.1	1.5	2.1	429,000	746,000	459,000
Gen. R. at Avon Gage	2.2	2.4	3.9	415,000	656,000	311,000
Gen. R. near Rush Rd.	2.3	2.8	2.2	391,000	602,000	252,000
Gen. R. at Browns Bridge Road (Rt. 253)	2.2	2.8	2.1	385,000	588,000	239,000
Gen. R. at Ballantyne Bridge Gage	2.1	2.2	1.9	347,000	511,000	181,000
Gen. R. at Rochester Airport	1.7	2.1	1.2	335,000	500,000	152,000
Gen. R. at Barge Canal Crossing	2.5	3.0	1.9	335,000	500,000	151,000
Gen. R. near Univ. of Rochester	4.6	4.8	5.0	335,000	499,000	151,000
Gen. R. at Court St.	4.7	4.9	3.9	334,000	499,000	150,000
Gen. R. at Central Ave.	7.4	7.5	9.0	334,000	499,000	150,000
Gen. R. at Rochester Gage	38.4	44.4	29.0	334,000	499,000	150,000

contribute no momentum. An analysis of the Canaseraga Creek junction as discussed in paragraph A3.20 indicated that it had little effect upon the Jones Bridge stage hydrograph, and was therefore simply treated as a noneffective flow area which also contributes discharge.

A4.6 In Table A4.2, a summary of maximum elevation, velocity, and discharge along with the time to maximum elevation at selected locations is presented. Temporal variation in the water surface slope produces a hysteresis (loop) effect upon the stage-discharge relation, resulting in a difference in time of maximum water surface elevation and maximum discharge.

Plate A31 and Plates A34 through A46 present the discharge and stage dam break PMF hydrographs at selected downstream locations. On Plate A47 an index to the flooded area maps is presented with the flooded areas shown on Plates A48 through A52 and A55. Flood profiles are shown on Plates A53, A54, and A56. As indicated in paragraph A4.5, Canaseraga Creek was treated as a noneffective flow area which accounts for the horizontal profile presented on Plate A56. Water would leave the Genesee River basin at the Barge Canal crossing and upstream of Court Street. The approximate extent of the overland flooding is delineated on Plates A48 and A49. Water through these areas would be sluggish and shallow.

A4.7 <u>Dam Failure at Full Pool</u>

The dam failure analyses for the full pool condition proceeded in a manner similar to the analysis for the dam break during the PMF. In Table A4.3, the selected breach parameters for the failure of Mt. Morris Dam during the full pool condition are presented. During the simulation of the dam failure, a constant inflow of 20,000 cfs to the Mt. Morris reservoir was assumed with a constant 5,000 cfs contributed downstream by Canaseraga Creek. The dam failure full pool discharge outflow hydrograph resulted in a peak outflow discharge of 1,090,000 cfs and is shown on Plate A32. Plate A33 and Plates A35 through A46 present the discharge and stage hydrographs at selected downstream locations.

Table A4.3 - Breach Parameters - Failure at Full Pool

Parameter	Value
Breach Width	150 Feet (3 Monoliths @ 50')
Side Slope of Breach	0:1 (Rectangular)
Failure Time	0.1 Hours
Failure Elevation	760.0 Feet (Maximum Pool)
Breach Bottom Elevation	580.0 Feet

A5. SUMMARY AND CONCLUSIONS

A5.1 As indicated in paragraph A3.32, the PMF discharge with and without the Mt. Morris Dam is essentially the same (2 percent difference) at the dam although the time of occurrence of the peak discharges differ by approximately 3 hours because the full reservoir pool accelerates the runoff. In accordance with ER 1110-2-1451 1/ no real estate interest will be required downstream of Mt. Morris Dam since the operation of the spillway does not increase the flood conditions. @

A5.2 The present PMF analysis results in a maximum spillway discharge of 442,000 cfs at the Mt. Morris Dam and a static pool elevation above the nonoverflow portion of the dam for 1/2-day. With a maximum reservoir pool surcharge elevation of 793.8 feet and 1.65 feet accounting for wave runup, the required elevation of nonoverflow section would be 795.5 feet. The actual Mt. Morris nonoverflow elevation is 790.0 feet. At present the Buffalo District is not considering structural modification of the Mt. Morris Dam. After the stability analysis utilizing the present PMF is completed, the effect of the PMF on the dam will be assessed and the appropriate recommendations will be made.

A5.3 As discussed in paragraphs A3.33 through A3.43, there has been a continuing problem of debris collecting of Mt. Morris Dam. The operation of the spillway will aggravate a potential hazard due to the debris movement within the downstream floodway. After screening other alternatives, the District is investigating construction of a log boom to retain debris from passing over the spillway during an overtopping event. Plans and Specifications will commence Fiscal Year 1981. @

A5.4 The Probable Maximum Flood (PMF) with and without failure of Mt. Morris Dam and the dam failure hydrograph for the full pool condition were hydraulically routed downstream from Mt. Morris Dam to the city of Rochester using the National Weather Service Dam Break Program, DAMBRK 8/. Flooded area maps and profiles were developed for the PMF with and without dam failure.

Revised 1984

A6. REFERENCES

1/ ER 1110-2-1451, "Acquisition of Lands Downstream from Spillways for Hydrologic Safety Purposes," dated 10 August 1978.

2/ ER 1130-2-419, "Dam Operations Management Policy," dated 18 May 1978.

3/ Reservoir Regulation Manual, Mt. Morris Dam and Reservoir, (Buffalo, NY, U.S. Army Corps of Engineers, 1978).

4/ Flood Hydrograph Package HEC-1, Computer Program 723-X6-L2010, (Corps of Engineers, Davis, CA, January 1973).

5/ Genesee River Basin Study of Water and Related Land Resources, (Corps of Engineers, Buffalo District, Volume IV, Appendix E - Hydrology, 1967).

6/ Hydrometeorological Report No. 51, "Probable Maximum Precipitation Estimates, United States East of the 105th Meridian," (Washington, DC, U.S. Department of Commerce, June 1978).

7/ Civil Engineer Bulletin No. 52-8, "Standard Project Flood Determinations," (Washington, DC, Department of the Army, Office of the Chief of Engineers, March 1965).

8/ Fread, D. L., DAMBRK: The NWS Dam-Break Flood Forecasting Model (Office of Hydrology, National Weather Service (NWS), Silver Spring, Maryland 20910, 1979).

9/ Summary Report on Review of Design Features of Existing Dams (U.S. Army Corps of Engineers, Buffalo District, 1967)

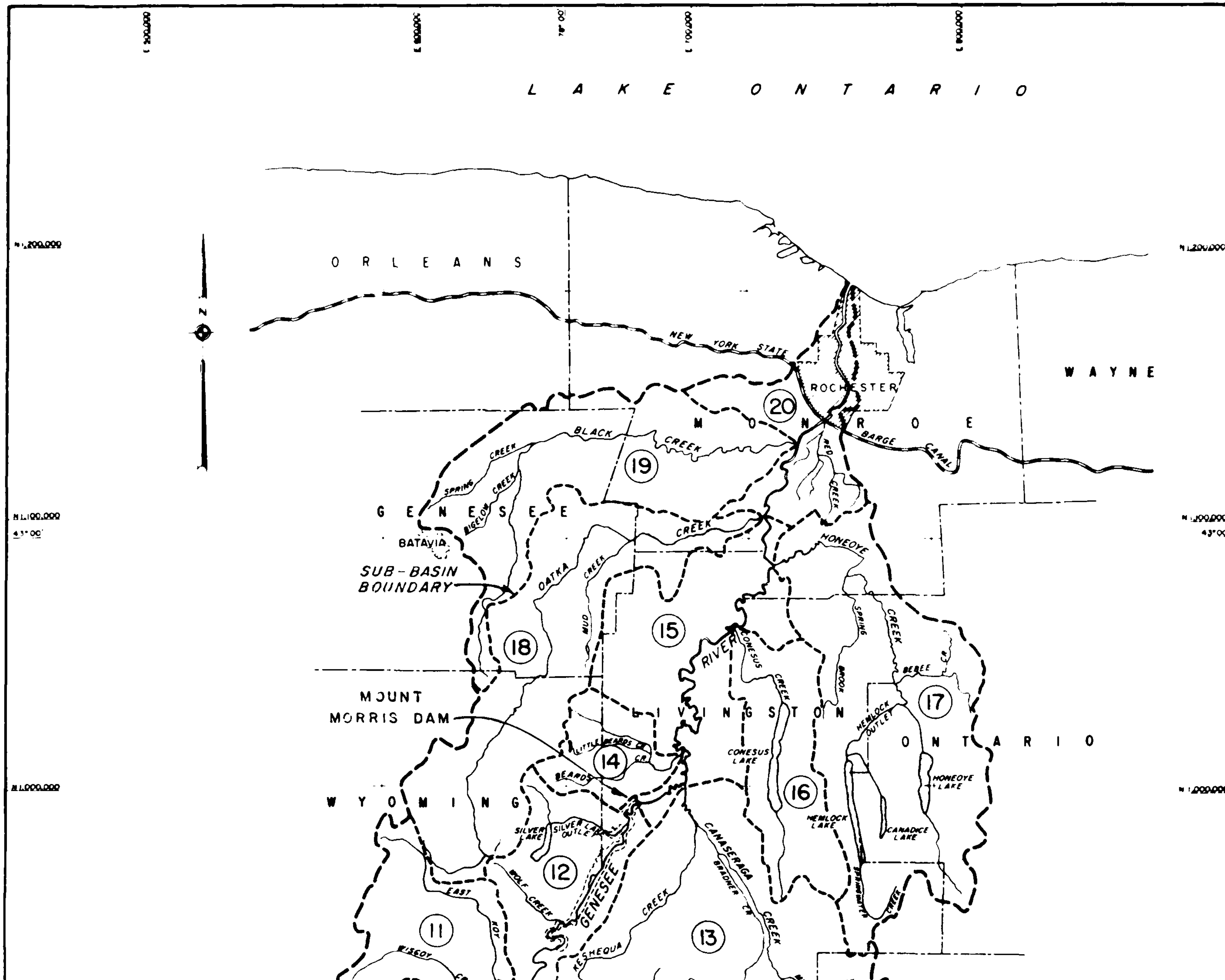
10/ Hydrometeorological Report No. 33, "Seasonal Variation of the Probable Maximum Precipitation East of the 105th Meridian for Areas from 10 to 1,000 Square Miles and Durations of 6, 12, 24, and 48 Hours," (U.S. Department of Commerce, Weather Bureau, Washington, DC, April, 1956).

11/ Barnes, George E., "A Report on Hydraulic Model Studies for the Spillway and Outlet Works of Mt. Morris Dam on the Genesee River," (Case School of Applied Science, Warner Hydraulics Laboratory, Cleveland, OH, March 31, 1946).

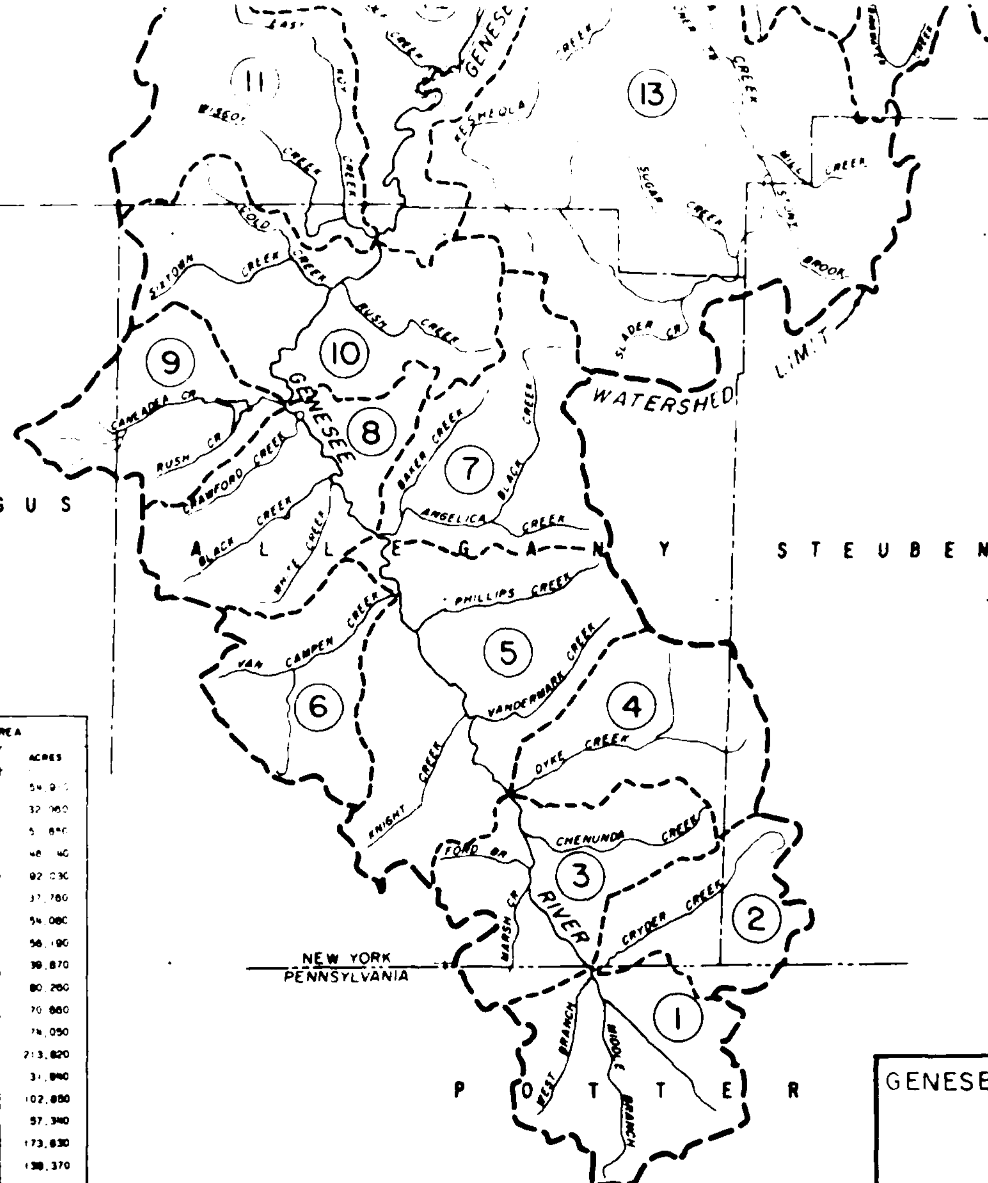
12/ Hydrometeorological Report No. 52, "Application of Probable Maximum Precipitation Estimates East of the 105th Meridian - Preliminary" (National Weather Service, Silver Spring, MD, November 1979).

13/ NCBED-HI Letter, HMR No. 52, "Application of Probable Maximum Estimates, United States East of the 105th Meridian (Prelim)," 6 February 1980.

14/ Flood Emergency Plans, Guidelines for Corps Dams, (Corps of Engineers, HEC, Davis, CA, June 1980).


LAKE ONTARIO
ORLEANS
WAYNE
MONROE
GENESEE
LIVINGSTON
ONTARIO
WYOMING
ROCHESTER
BATAVIA
NEW YORK STATE BARGE CANAL
SUB-BASIN BOUNDARY
MOUNT MORRIS DAM
GENESEE RIVER
BLACK CREEK
SPRING CREEK
BIGELOW CREEK
OATKA CREEK
MUD CREEK
RED CREEK
HONEOYE CREEK
SPRING BROOK
BEBEE CR.
HEMLOCK OUTLET
CONESUS CREEK
CONESUS LAKE
HEMLOCK LAKE
CANADICE LAKE
HONEOYE LAKE
SPRINGWATER CREEK
CANASERAGA CREEK
BRADNER CR.
KESHEQUA CREEK
LITTLE BEARDS CR.
BEARDS CR.
SILVER LAKE
SILVER LAKE OUTLET
WOLF CREEK
EAST KOY CREEK
WISCOY CR.
11
12
13
14
15
16
17
18
19
20

/



SUBWATERSHED AREAS

SUBWATERSHED NUMBER	SUBWATERSHED NAME	DRAINAGE AREA SQUARE MILES	DRAINAGE AREA ACRES
	GENESEE - SOUTH	85.8	54,9[illegible]
2	CRYDER CREEK	50	32,000
3	GENESEE - CHENUNDA	80.7	5[illegible],6[illegible]0
4	DYKE CREEK	7[illegible]	46,[illegible]40
5	GENESEE - VANDERMARK	43.8	92,030
6	VAN CAMPEN CREEK	59.0	37,760
7	ANGELICA CREEK	84.5	54,080
8	GENESEE - SOUTH BLACK	87.8	56,190
9	CANEADEA CREEK	62.3	39,870
	GENESEE - COLD CREEK	125.4	80,260
	WISCOY CREEK	110.4	70,660
12	SILVER LAKE OUTLET	115.7	74,050
13	CANASERAGA CREEK	334.1	213,820
14	BEARDS CREEK	48.9	31,040
15	GENESEE - GENESEO	160.7	102,850
16	CONESUS LAKE	89.6	57,340
17	HONEOYE CREEK	271.3	173,630
18	OATKA CREEK	216.2	138,370
19	BLACK CREEK	213.8	136,800
20	GENESEE - ROCHESTER	88.1	52,300
TOTAL		2,479.4	1,[illegible],010

DATA COMPILED BY U.S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE. ADDITIONAL BREAKDOWN OF DRAINAGE AREA DATA WITHIN A SUBWATERSHED AVAILABLE FROM MR. J. MITCHELL, RIVER BASIN REPRESENTATIVE, SOIL CONSERVATION SERVICE, 21 SOUTH GROVE STREET, EAST AURORA, NEW YORK

COUNTY AREAS

COUNTY	TOTAL AREA OF COUNTY* SQ MI	AREA WITHIN GENESEE RIVER BASIN** SQ MI
NEW YORK		
ALLEGANY	1,048	769.8
CATTARAUGUS	1,335	14.0
GENESEE	501	202.6
LIVINGSTON	638	619.4
MONROE	673	248.8
ONTARIO	649	138.8
ORLEANS	396	4.0
STEUBEN	1,408	66.7
WAYNE (SERVICE AREA)	607	0
WYOMING	598	301.7
PENNSYLVANIA		
POTTER	1,090	95.6
		2,479.4

* AREA BASED ON 1960 U.S. CENSUS, U.S. DEPARTMENT OF COMMERCE

** DATA COMPILED BY U.S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE

SCALE IN MILES

5 0 5

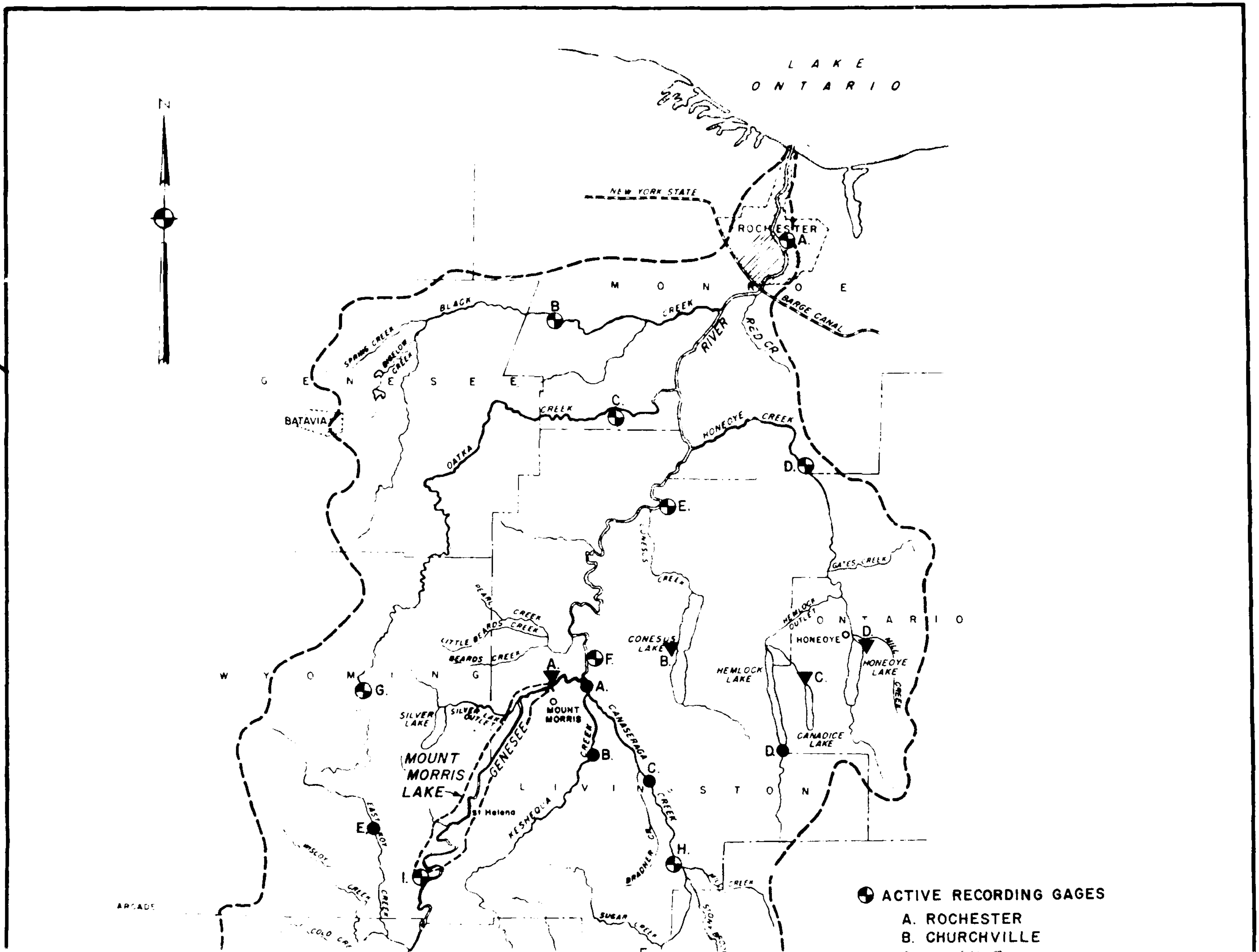
GENESEE RIVER BASIN, NEW YORK

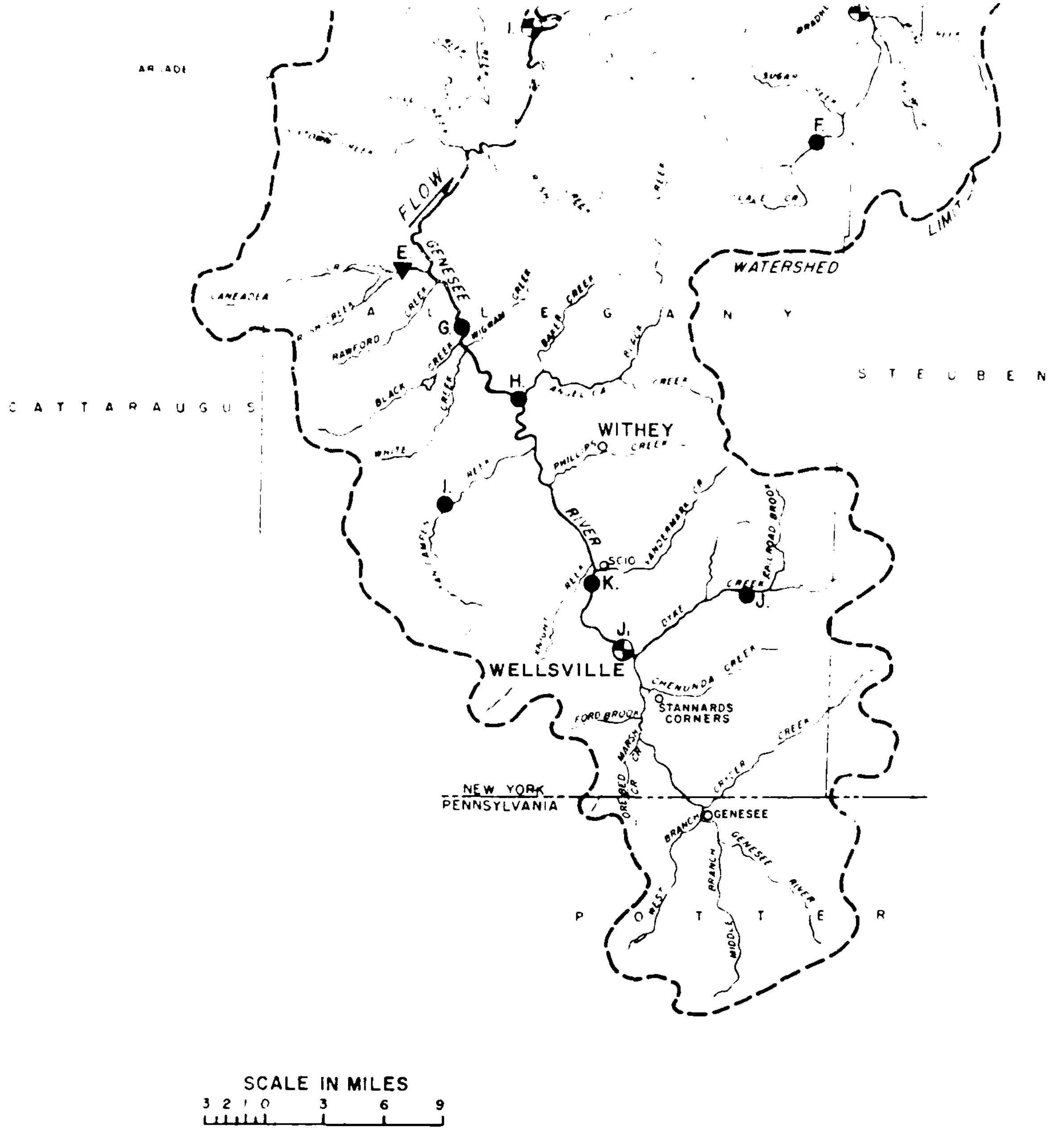
BASIN MAP

U.S. ARMY ENGINEER DISTRICT BUFFALO

PLATE A1

2


LAKE ONTARIO
NEW YORK STATE
ROCHESTER
A.
MONROE
BARGE CANAL
RED CR
RIVER
BLACK
CREEK
B
SPRING CREEK
GENESEE
BATAVIA
C.
CREEK
OATKA
HONEOYE CREEK
D.
E.
GATES CREEK
ONTARIO
HONEOYE
HEMLOCK OUTLET
HONEOYE LAKE
MILL CREEK
HEMLOCK LAKE
CANADICE LAKE
CONESUS LAKE
PEARL CREEK
LITTLE BEARDS CREEK
BEARDS CREEK
F.
WYOMING
G.
SILVER LAKE
SILVER LAKE OUTLET
MOUNT MORRIS
MOUNT MORRIS LAKE
GENESEE
CANASERAGA
KESHEQUA
LIVINGSTON
St Helena
EAST KOY
H.
I.
SUGAR CREEK
BRADNER CR.
ARCADE
ACTIVE RECORDING GAGES
A. ROCHESTER
B. CHURCHVILLE



- ACTIVE RECORDING GAGES
  - A. ROCHESTER
  - B. CHURCHVILLE
  - C. GARBUTT
  - D. HONEOYE FALLS
  - E. AVON
  - F. GENESEE RIVER NEAR MT. MORRIS (JONES BRIDGE)
  - G. WARSAW
  - H. DANSVILLE
  - I. PORTAGEVILLE (RELOCATED)
  - J. WELLSVILLE (REPLACES SCIO)
- DISCONTINUED RECORDING GAGES
  - A. SHAKERS CROSSING (1970)
  - B. SONYEA (1932)
  - C. GROVELAND (1964)
  - D. SPRINGWATER (1968)
  - E. EAST KOY (1968)
  - F. CANASERAGA (1968)
  - G. BELFAST (1967)
  - H. ANGELICA-TRANSIT BRIDGE (1968)
  - I. FRIENDSHIP (1968)
  - J. ANDOVER (1968)
  - K. SCIO (DESTROYED JUNE 1972)
- LAKE STAGE GAGES
  - A MT. MORRIS LAKE
  - B. CONESUS LAKE (NEAR LAKEVILLE)
  - C. CANADICE LAKE
  - D. HONEOYE LAKE
  - E. CANEADEA DAM (REPLACES CANEADEA)

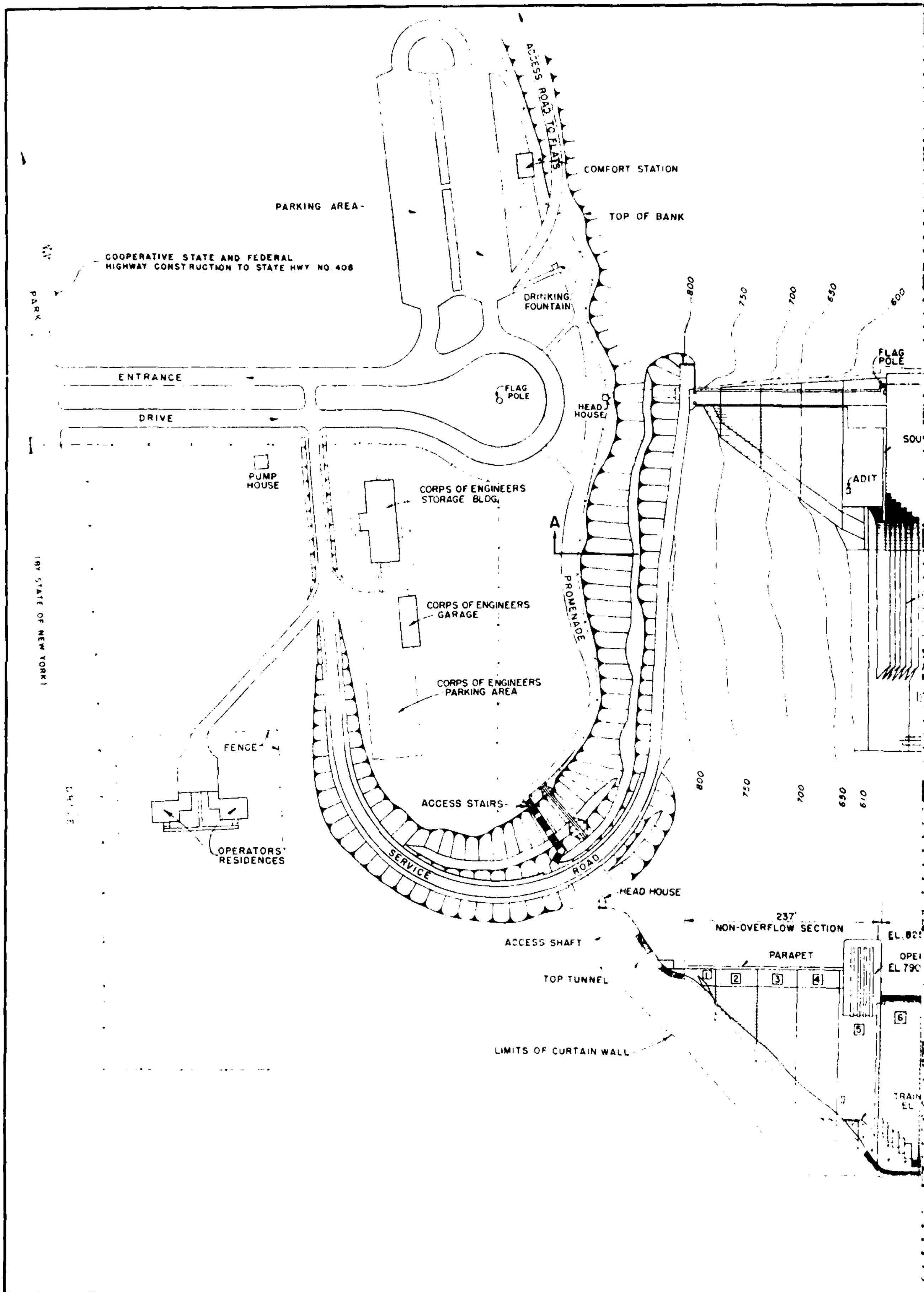
GENESEE RIVER BASIN
N.Y.

GAGE LOCATIONS

U.S. ARMY ENGINEER DISTRICT, BUFFALO

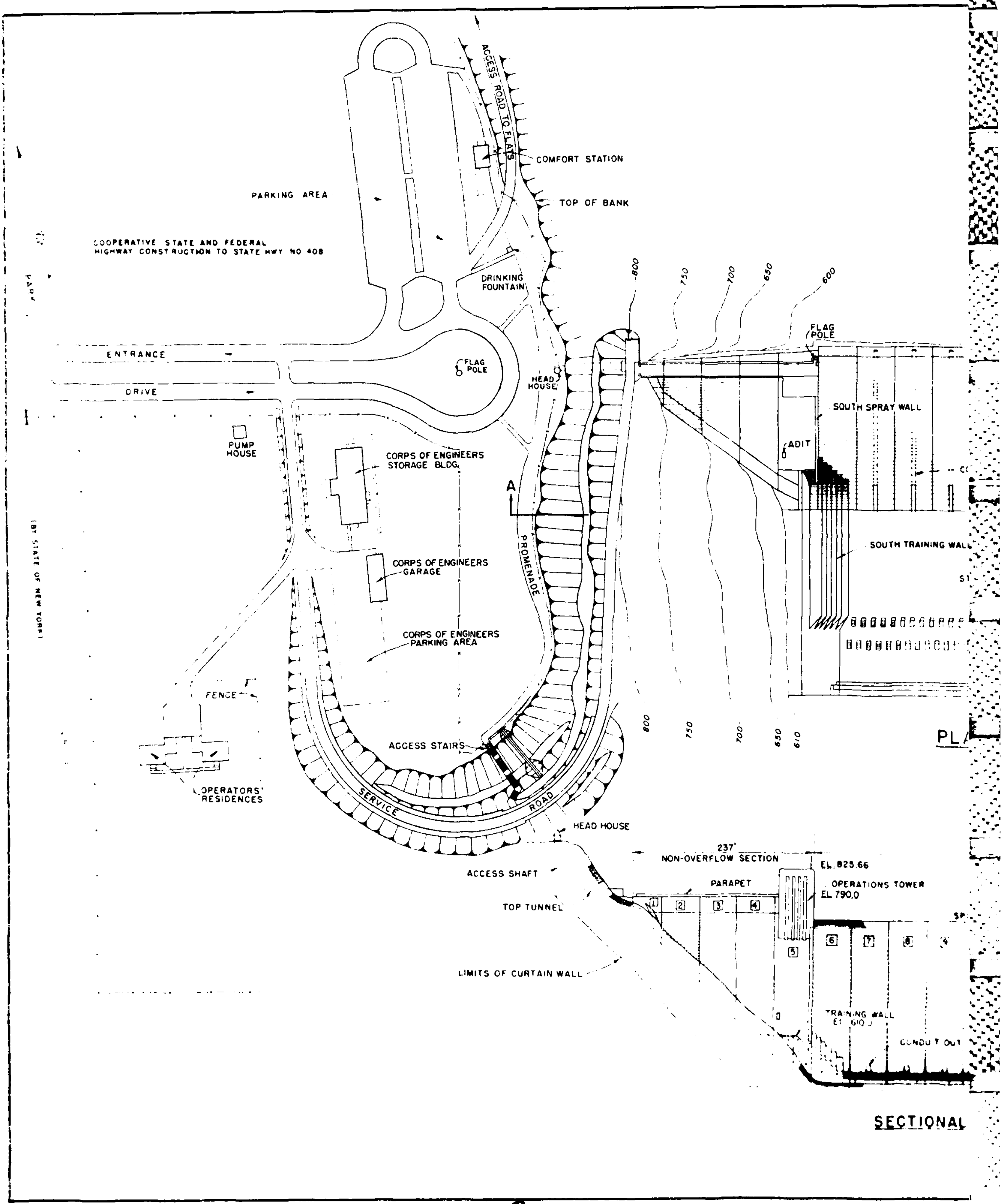
PLATE A2

2

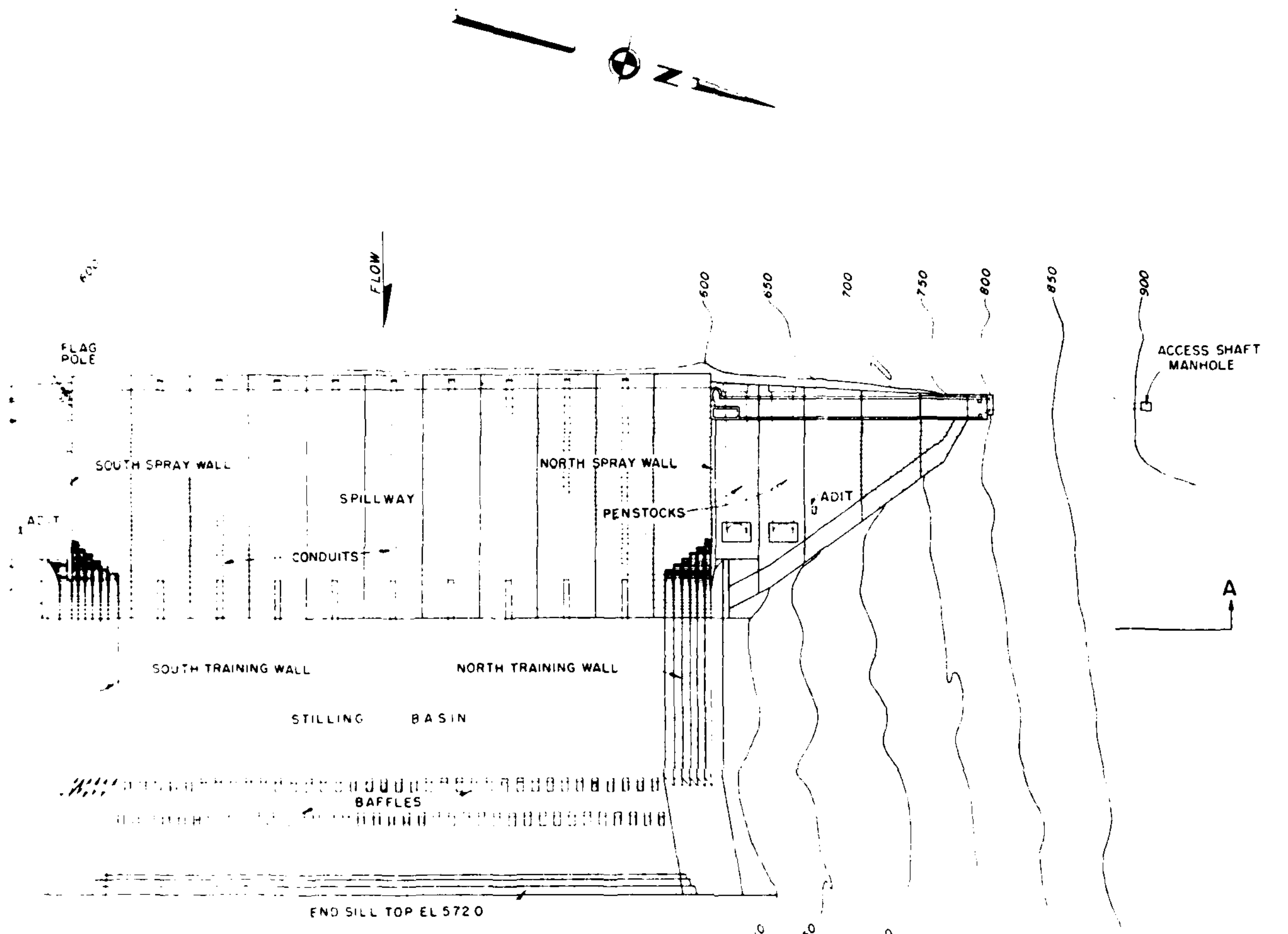


ACCESS ROAD TO FLATS
COMFORT STATION
TOP OF BANK
PARKING AREA
COOPERATIVE STATE AND FEDERAL
HIGHWAY CONSTRUCTION TO STATE HWY NO. 408
PARK
DRINKING FOUNTAIN
800
750
700
650
600
FLAG POLE
ENTRANCE
DRIVE
FLAG POLE
HEAD HOUSE
ADIT
PUMP HOUSE
CORPS OF ENGINEERS STORAGE BLDG.
A
PROMENADE
CORPS OF ENGINEERS GARAGE
(BY STATE OF NEW YORK)
CORPS OF ENGINEERS PARKING AREA
FENCE
800
750
700
650
610
ACCESS STAIRS
OPERATORS' RESIDENCES
SERVICE
ROAD
HEAD HOUSE
237'
NON-OVERFLOW SECTION
ACCESS SHAFT
PARAPET
TOP TUNNEL
1
2
3
4
5
6
EL. 790
LIMITS OF CURTAIN WALL

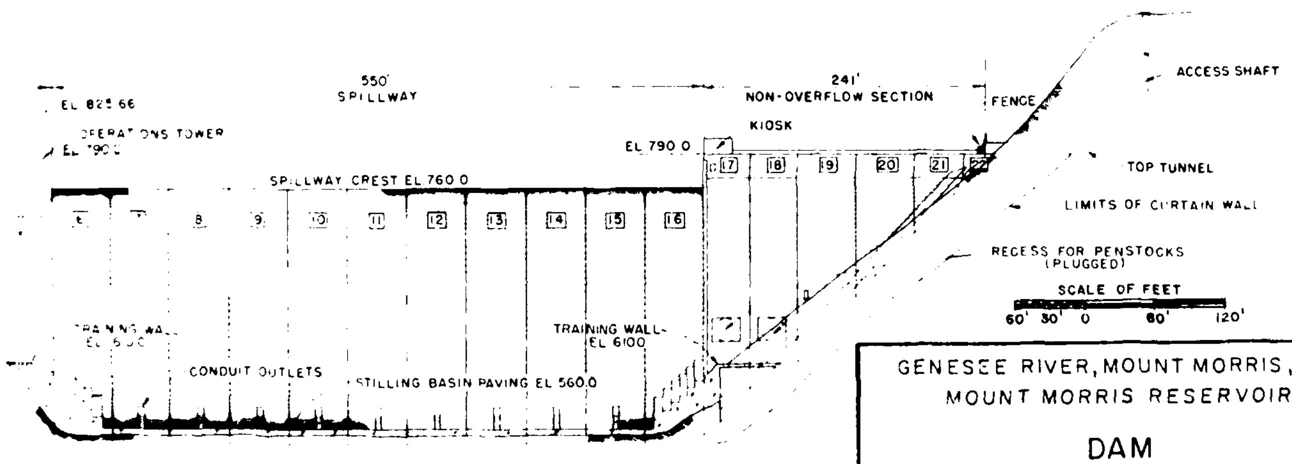
PLATE A 3


ACCESS ROAD TO FLATS
COMFORT STATION
TOP OF BANK
PARKING AREA
COOPERATIVE STATE AND FEDERAL HIGHWAY CONSTRUCTION TO STATE HWY NO 408
DRINKING FOUNTAIN
ENTRANCE
DRIVE
FLAG POLE
HEAD HOUSE
PUMP HOUSE
CORPS OF ENGINEERS STORAGE BLDG
A
PROMENADE
CORPS OF ENGINEERS GARAGE
CORPS OF ENGINEERS PARKING AREA
FENCE
(BY STATE OF NEW YORK)
ACCESS STAIRS
OPERATORS' RESIDENCES
SERVICE ROAD
HEAD HOUSE
800
750
700
650
600
610
FLAG POLE
SOUTH SPRAY WALL
ADIT
SOUTH TRAINING WALL
237'
NON-OVERFLOW SECTION
EL. 825.66
PARAPET
OPERATIONS TOWER
EL 790.0
ACCESS SHAFT
TOP TUNNEL
LIMITS OF CURTAIN WALL
1
2
3
4
5
6
7
8
TRAINING WALL
SECTIONAL

2



PLAN OF DAM



SECTIONAL ELEVATION AT A-A

GENESEE RIVER, MOUNT MORRIS, N.Y.
MOUNT MORRIS RESERVOIR

DAM
PLAN AND ELEVATION

U.S. ARMY ENGINEER DISTRICT BUFFALO

3

PLATE A3

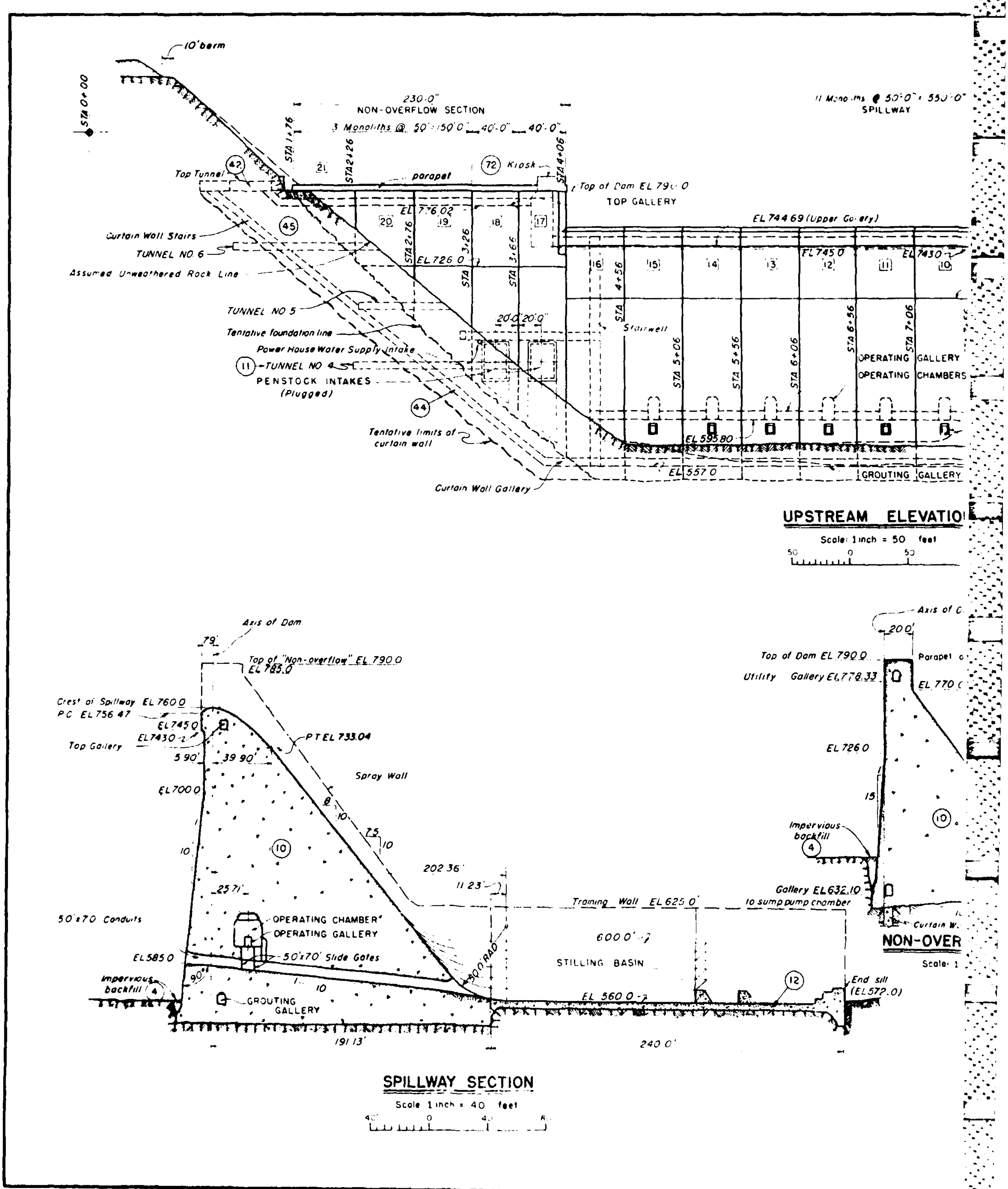
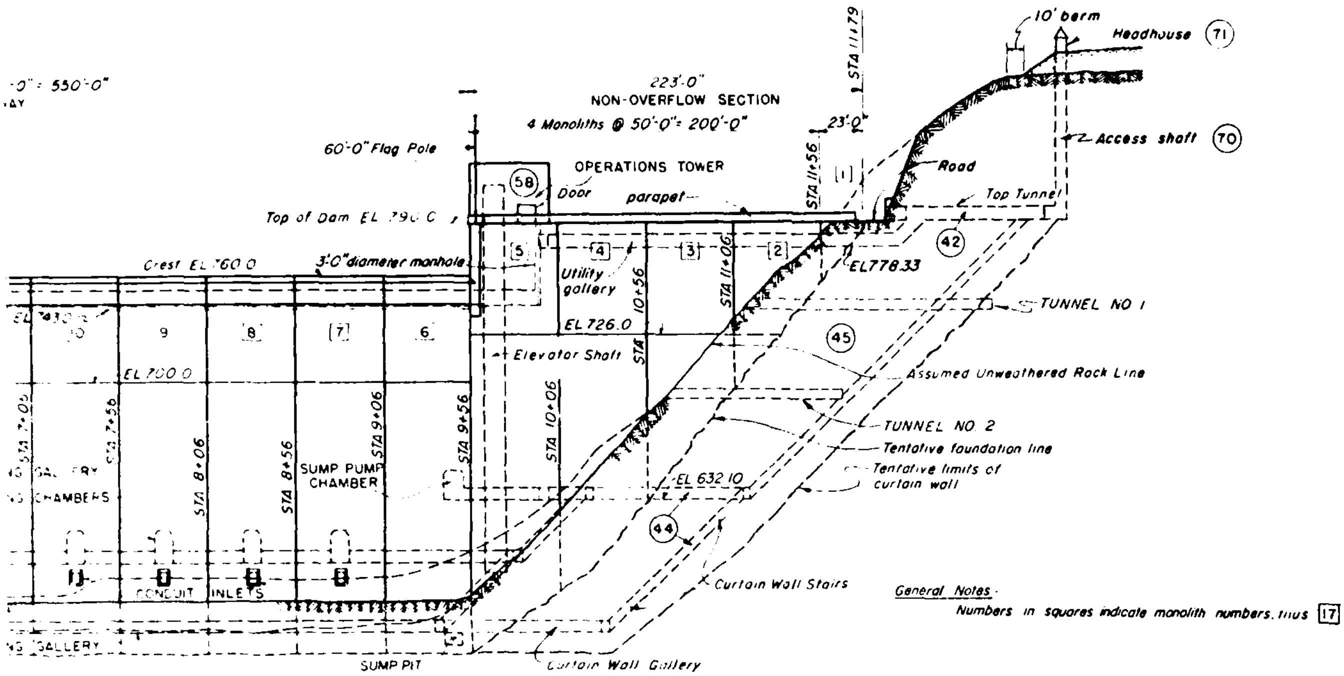
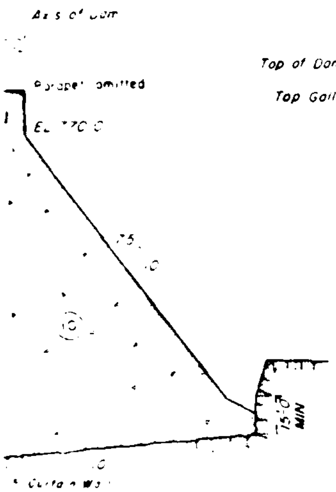

10' berm
STA 0+00
230.0"
NON-OVERFLOW SECTION
3 Monoliths @ 50' = 150' 0" 40'-0" 40'-0"
11 Monoliths @ 50'-0" = 550'-0"
SPILLWAY
STA 1+76
STA 2+26
Top Tunnel
parapet
Kiosk
STA 4+06
Top of Dam EL 790.0
TOP GALLERY
EL 776.02
EL 744.69 (Upper Gallery)
Curtain Wall Stairs
TUNNEL NO 6
Assumed Unweathered Rock Line
STA 2+76
STA 3+26
STA 3+66
EL 726.0
EL 745.0
EL 743.0
STA 4+56
TUNNEL NO 5
Tentative foundation line
Stairwell
Power House Water Supply Intake
TUNNEL NO 4
PENSTOCK INTAKES
(Plugged)
STA 5+06
STA 5+56
STA 6+06
STA 6+56
STA 7+06
OPERATING GALLERY
OPERATING CHAMBERS
Tentative limits of curtain wall
EL 595.80
EL 557.0
GROUTING GALLERY
Curtain Wall Gallery
UPSTREAM ELEVATION
Scale: 1 inch = 50 feet
Axis of Dam
Top of "Non-overflow" EL 790.0
EL 785.0
Crest of Spillway EL 760.0
PC EL 756.47
EL 745.0
EL 743.0
Top Gallery
5.90'
39.90'
P T EL 733.04
Spray Wall
EL 700.0
202.36'
11.23'
25.71'
50'x70 Conduits
OPERATING CHAMBER
OPERATING GALLERY
50'x70' Slide Gates
Training Wall EL 625.0'
600.0'
STILLING BASIN
EL 585.0
Impervious backfill
GROUTING GALLERY
EL 560.0
End sill (EL 572.0)
191.13'
240.0'
SPILLWAY SECTION
Scale 1 inch = 40 feet
Axis of Dam
20.0'
Top of Dam EL 790.0
Parapet
Utility Gallery EL 778.33
EL 770.0
EL 726.0
Impervious backfill
Gallery EL 632.10
to sump pump chamber
Curtain Wall
NON-OVER
Scale 1

PLATE A4

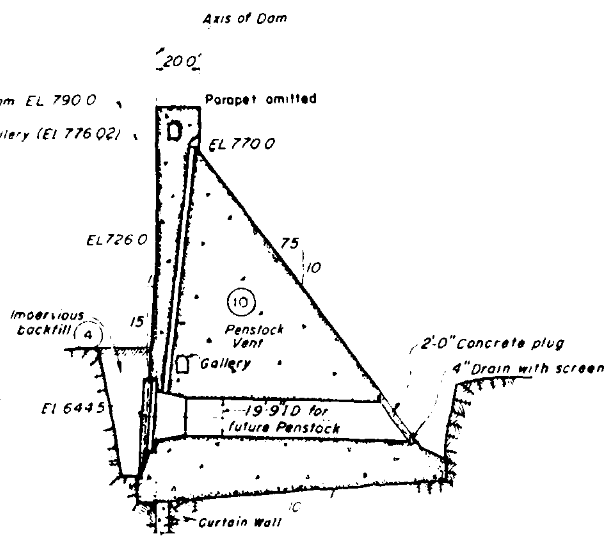


LEVATION



ON-OVERFLOW SECTION

Scale: 1 inch = 40 feet



SECTION THROUGH PENSTOCK

Scale: 1 inch = 40 feet

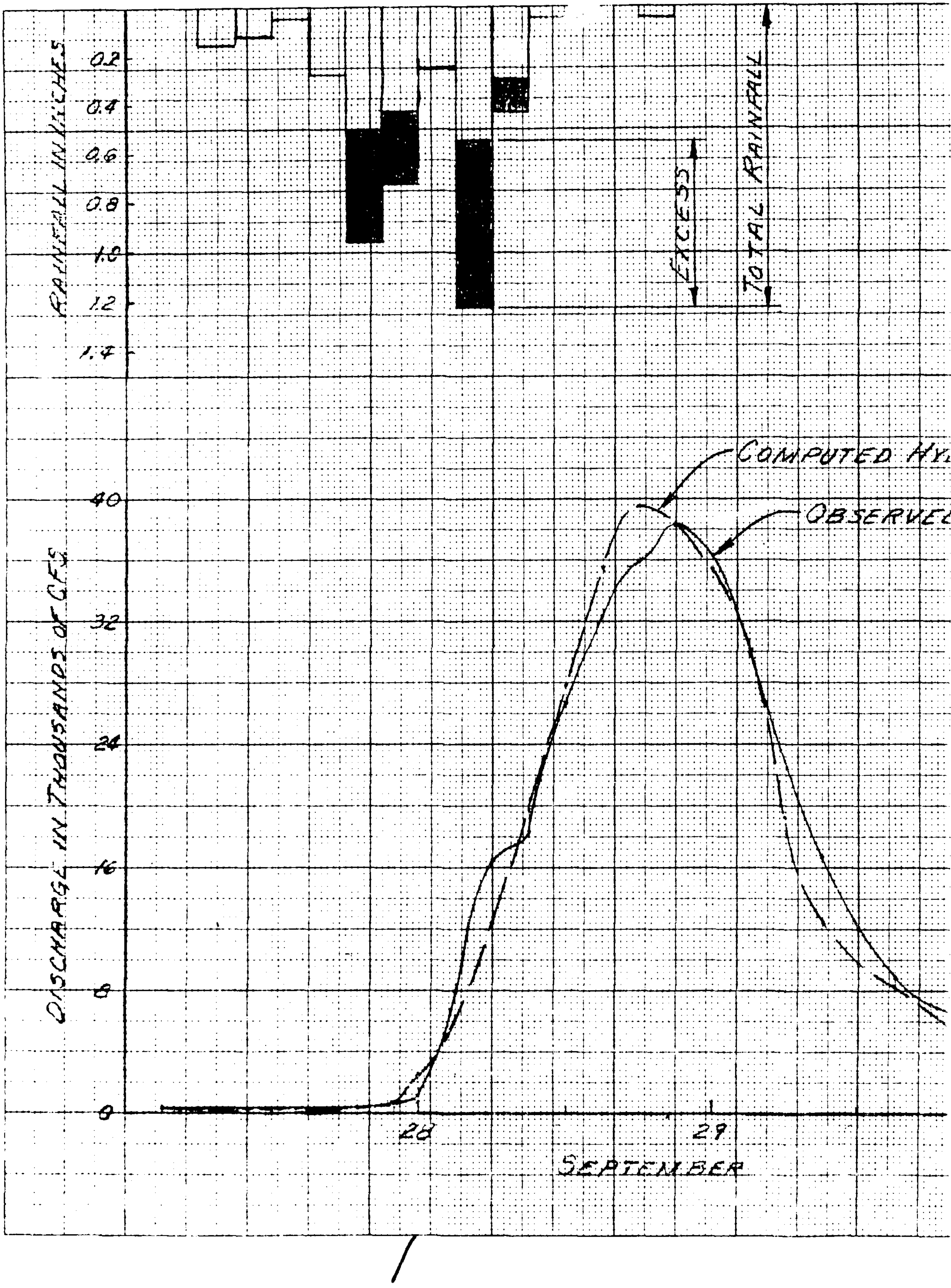
GENESEE RIVER, MOUNT MORRIS, N.Y.
MOUNT MORRIS RESERVOIR

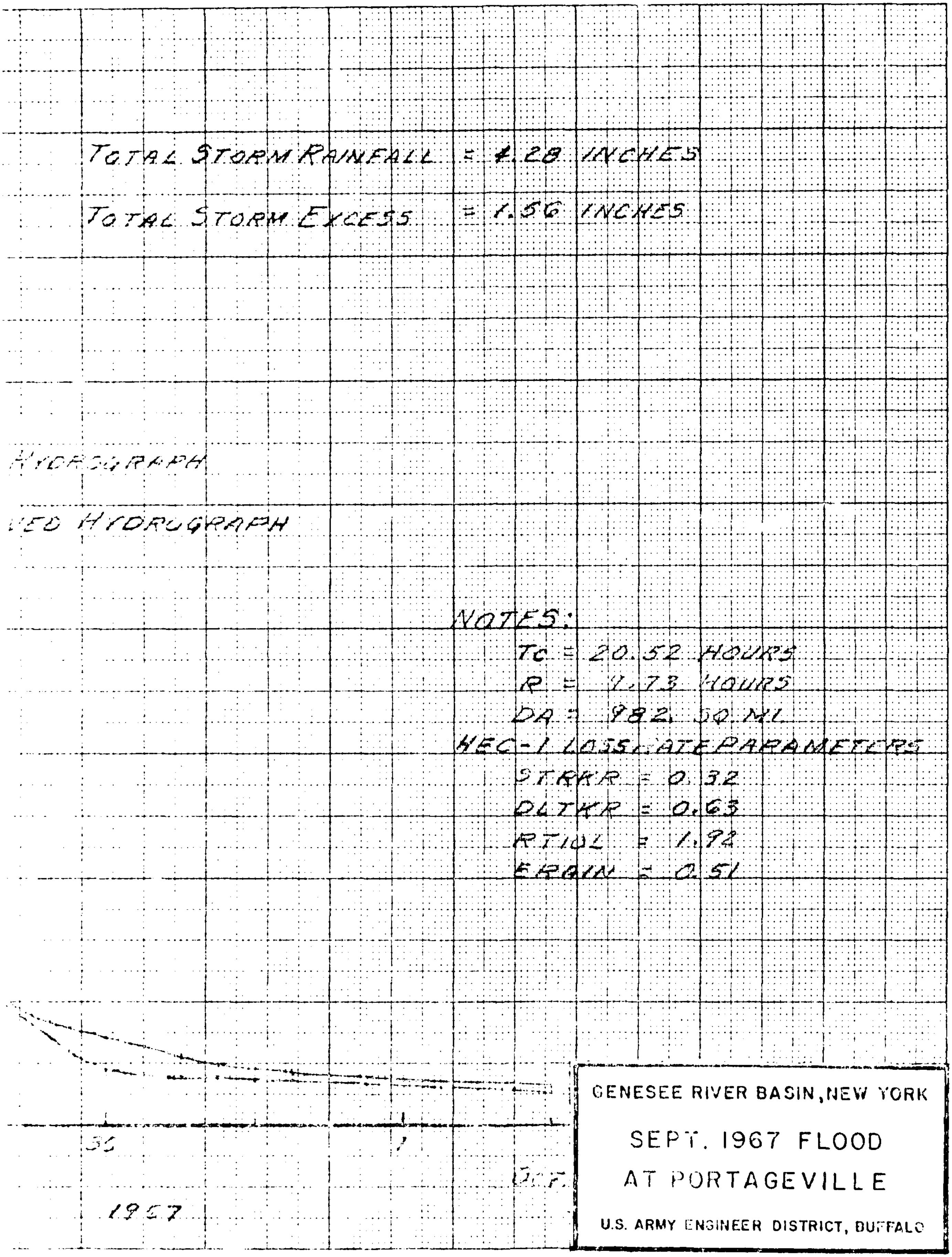
DAM
UPSTREAM ELEVATION
AND TYPICAL SECTIONS

U.S. ARMY ENGINEER DISTRICT BUFFALO

PLATE A-1

2


RAINFALL IN INCHES
0.2
0.4
0.6
0.8
1.0
1.2
1.4
EXCESS
TOTAL RAINFALL
COMPUTED HY
OBSERVED
DISCHARGE IN THOUSANDS OF CFS
40
32
24
16
8
0
28
29
SEPTEMBER



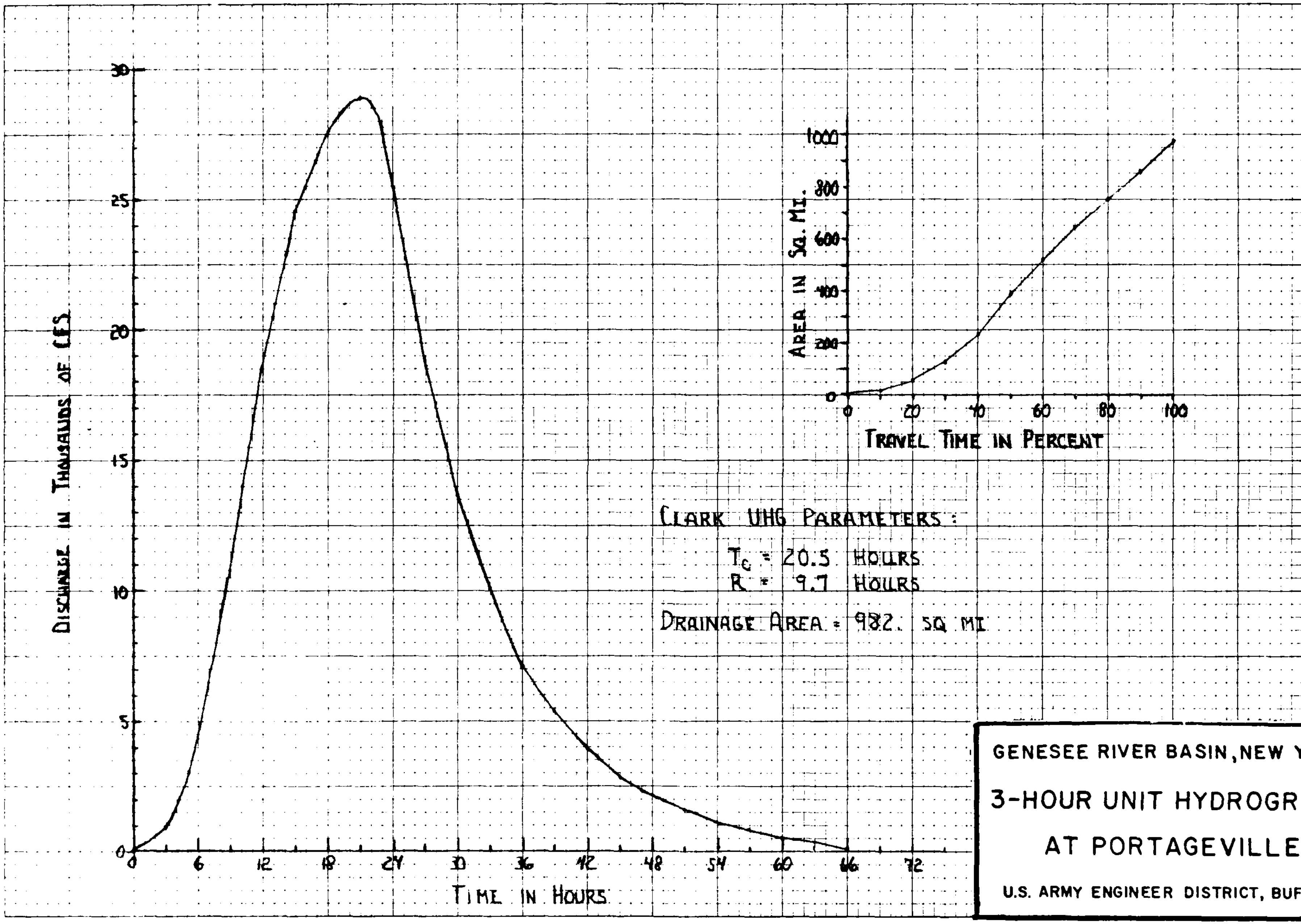
GENESEE RIVER BASIN, NEW YORK

SEPT. 1967 FLOOD
AT PORTAGEVILLE

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A5

2



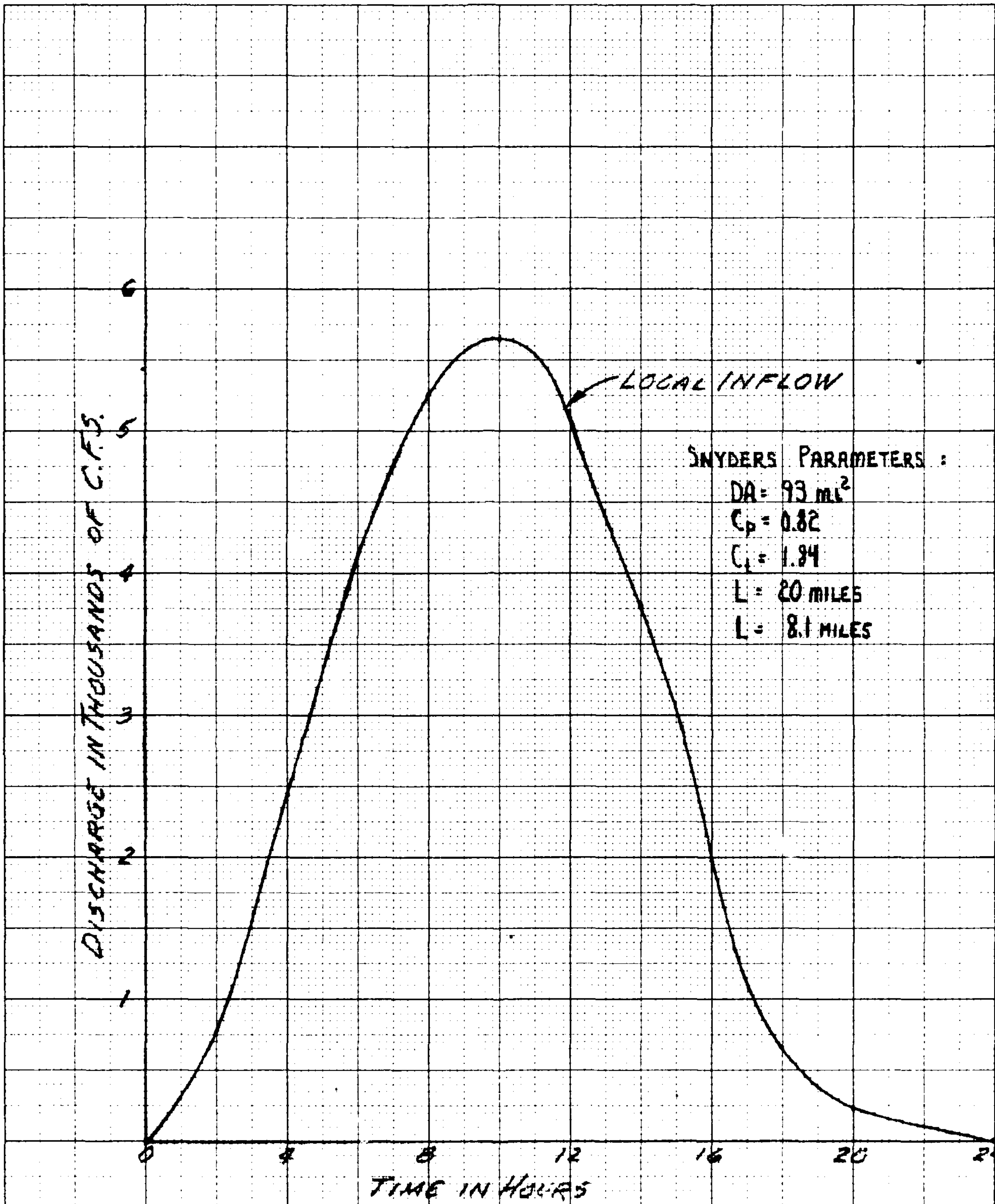
GENESEE RIVER BASIN, NEW YORK

3-HOUR UNIT HYDROGRAPH

AT PORTAGEVILLE

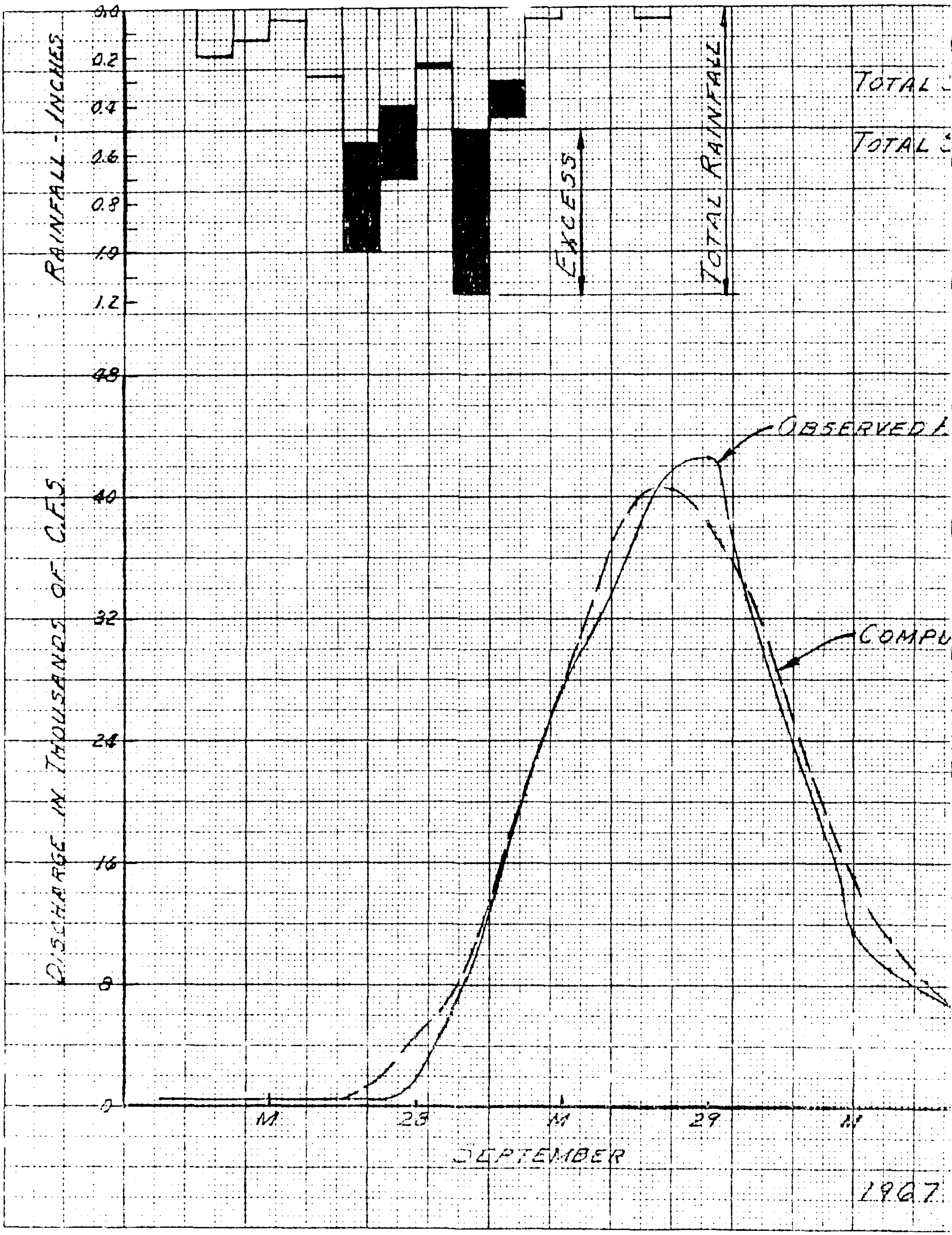
U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A6



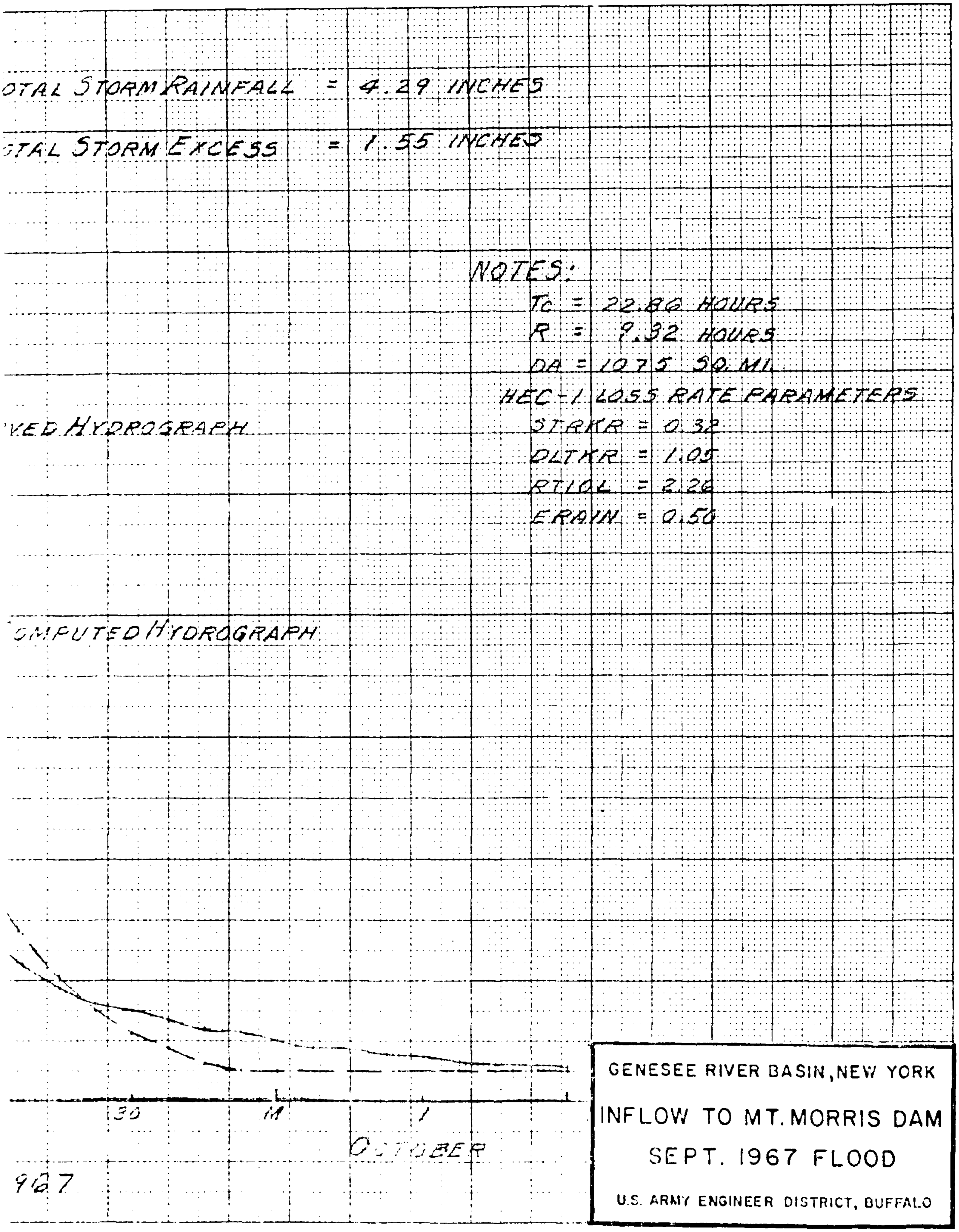
GENESEE RIVER BASIN, NEW YORK
2-HOUR UNIT HYDROGRAPH
FOR LOCAL INFLOW
BETWEEN PORTAGEVILLE AND
THE SITE OF MT. MORRIS DAM
U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A7



RAINFALL - INCHES
0.0
0.2
0.4
0.6
0.8
1.0
1.2
TOTAL
TOTAL
EXCESS
TOTAL RAINFALL
48
40
32
24
16
8
0
DISCHARGE IN THOUSANDS OF C.F.S.
OBSERVED
COMPU
M
28
M
29
M
SEPTEMBER
1967

/



GENESEE RIVER BASIN, NEW YORK

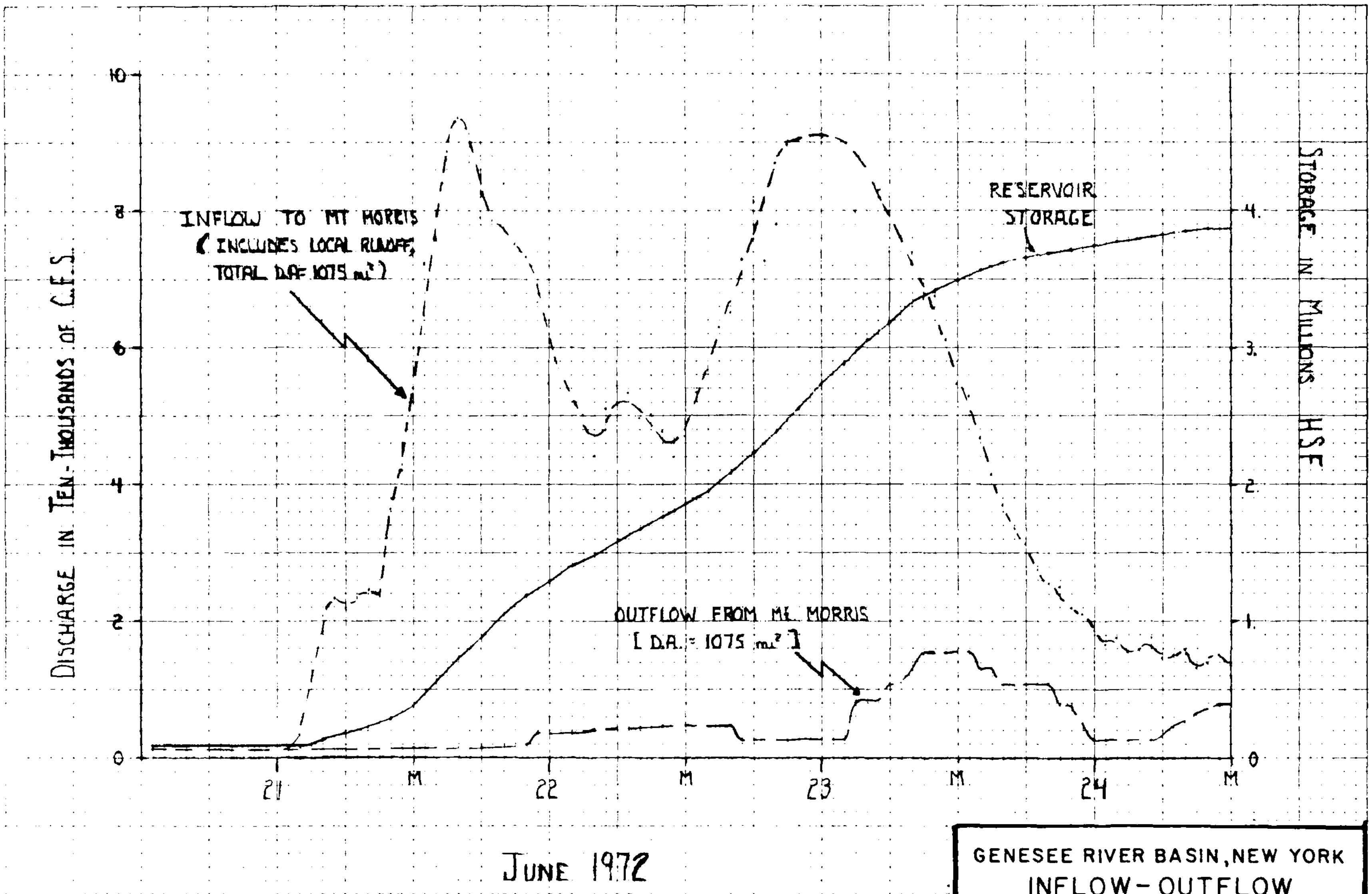
INFLOW TO MT. MORRIS DAM

SEPT. 1967 FLOOD

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A8

2

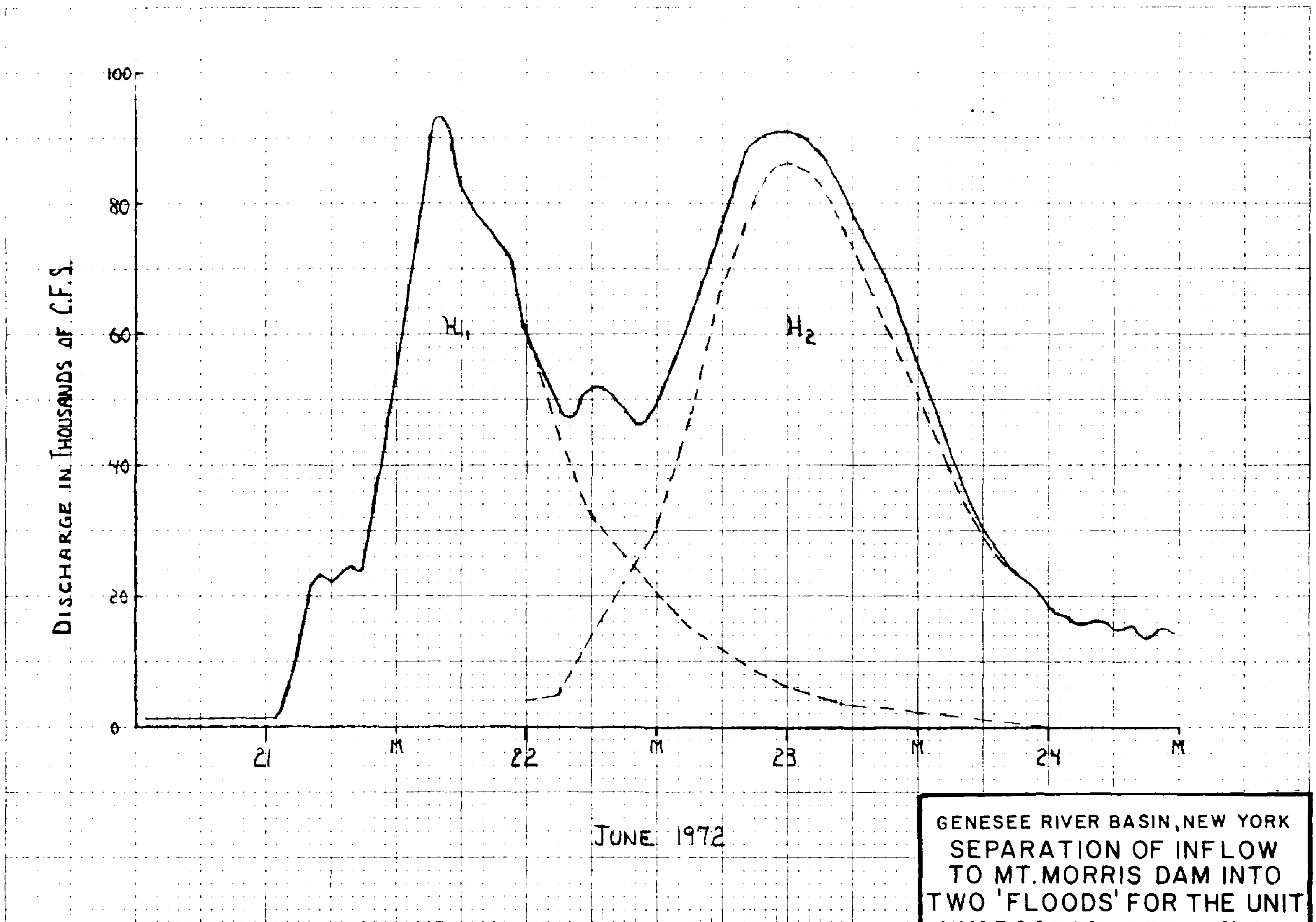


GENESEE RIVER BASIN, NEW YORK

INFLOW-OUTFLOW HYDROGRAPHS FOR MT. MORRIS DAM JUNE 1972 FLOOD

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A9

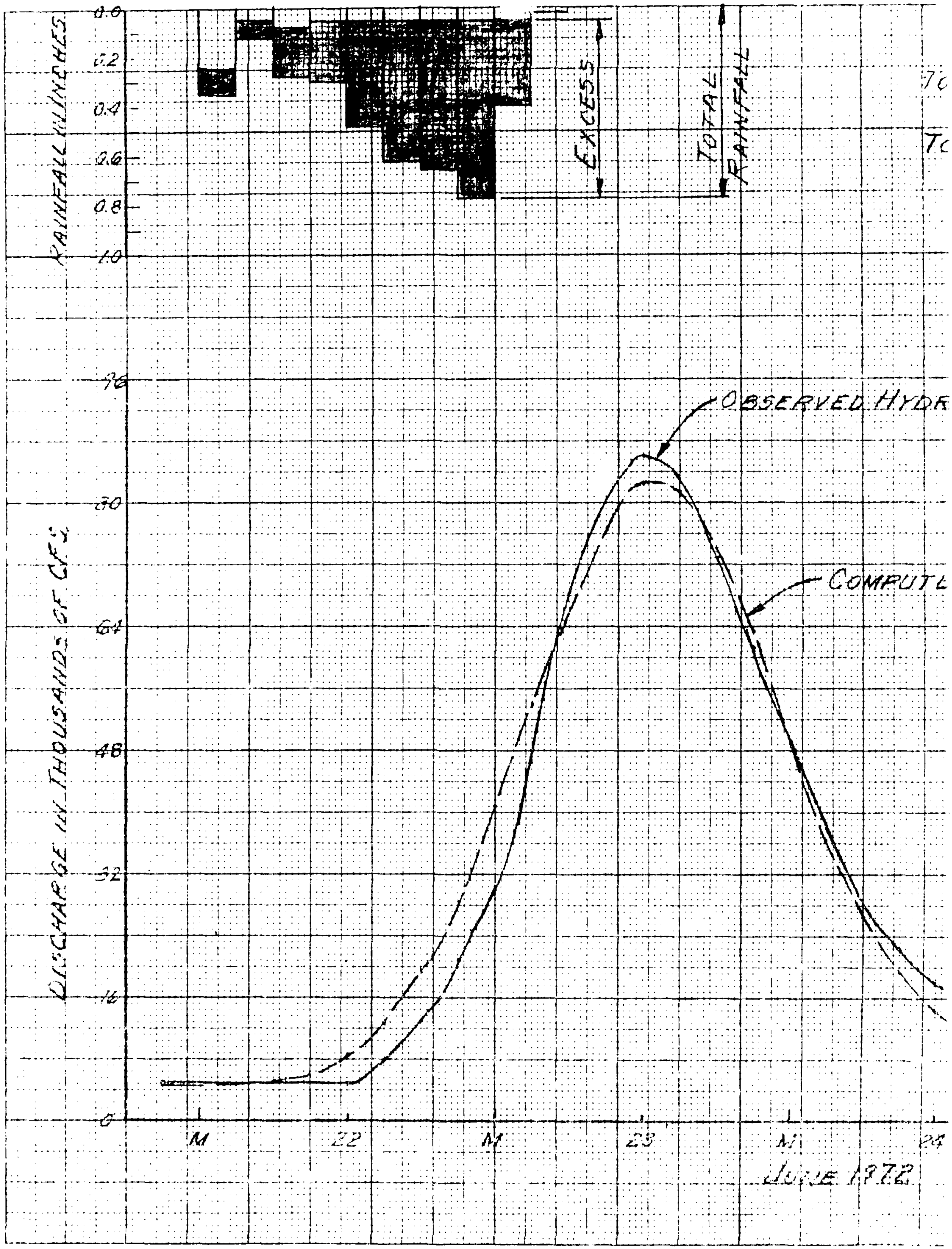


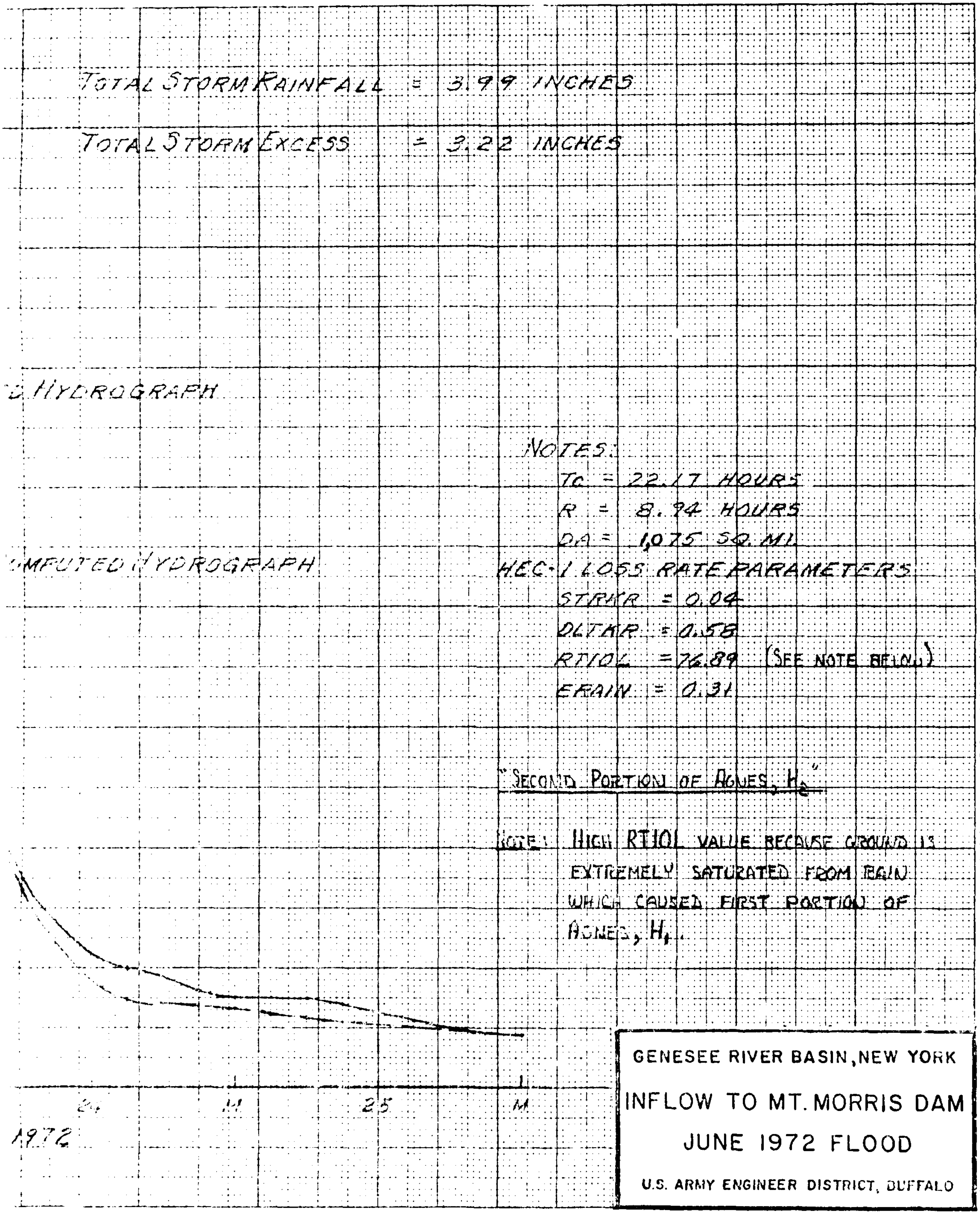
GENESEE RIVER BASIN, NEW YORK

SEPARATION OF INFLOW TO MT. MORRIS DAM INTO TWO 'FLOODS' FOR THE UNIT HYDROGRAPH DERIVATION

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A10


RAINFALL IN INCHES
0.0
0.2
0.4
0.6
0.8
1.0
EXCESS
TOTAL RAINFALL
OBSERVED HYDR
COMPUTE
DISCHARGE IN THOUSANDS OF CFS
96
80
64
48
32
16
0
M
22
M
23
M
24
JUNE 1972



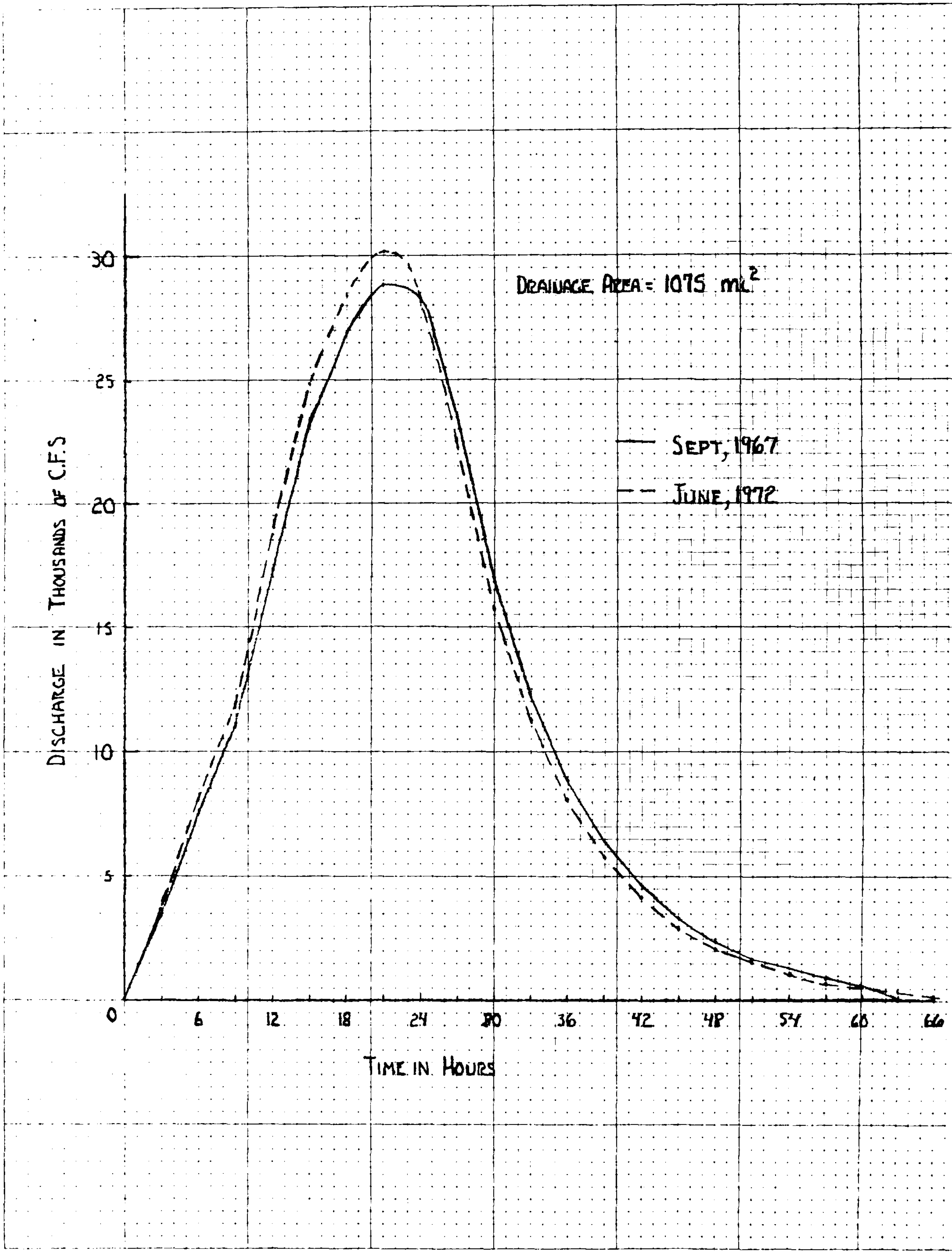
GENESEE RIVER BASIN, NEW YORK

INFLOW TO MT. MORRIS DAM

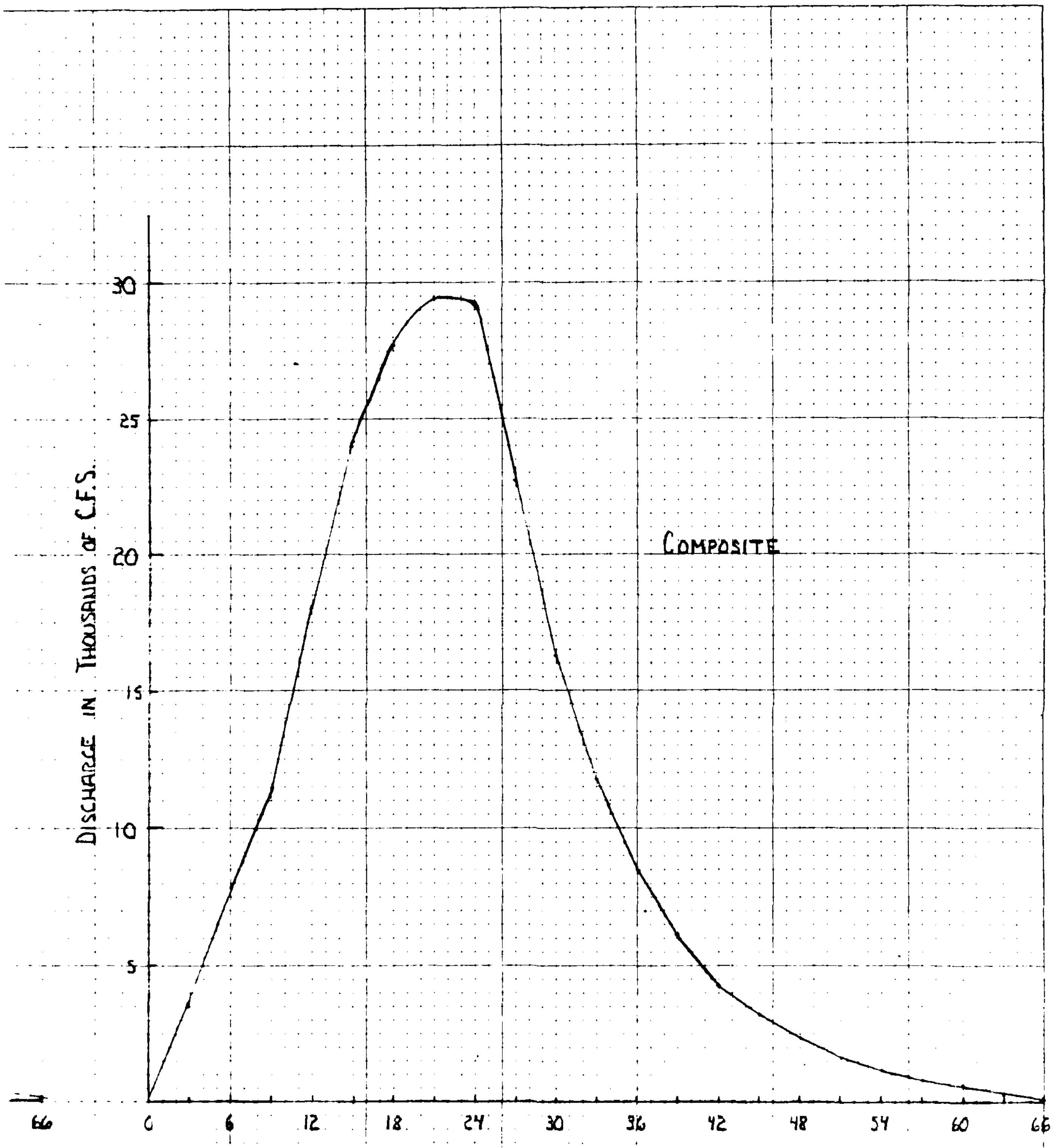
JUNE 1972 FLOOD

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A11



DRAINAGE AREA = 1075 mi.^{2}
SEPT, 1967
JUNE, 1972
DISCHARGE IN THOUSANDS OF C.F.S.
30
25
20
15
10
5
0
6
12
18
24
30
36
42
48
54
60
66
TIME IN HOURS



GENESEE RIVER BASIN, NEW YORK

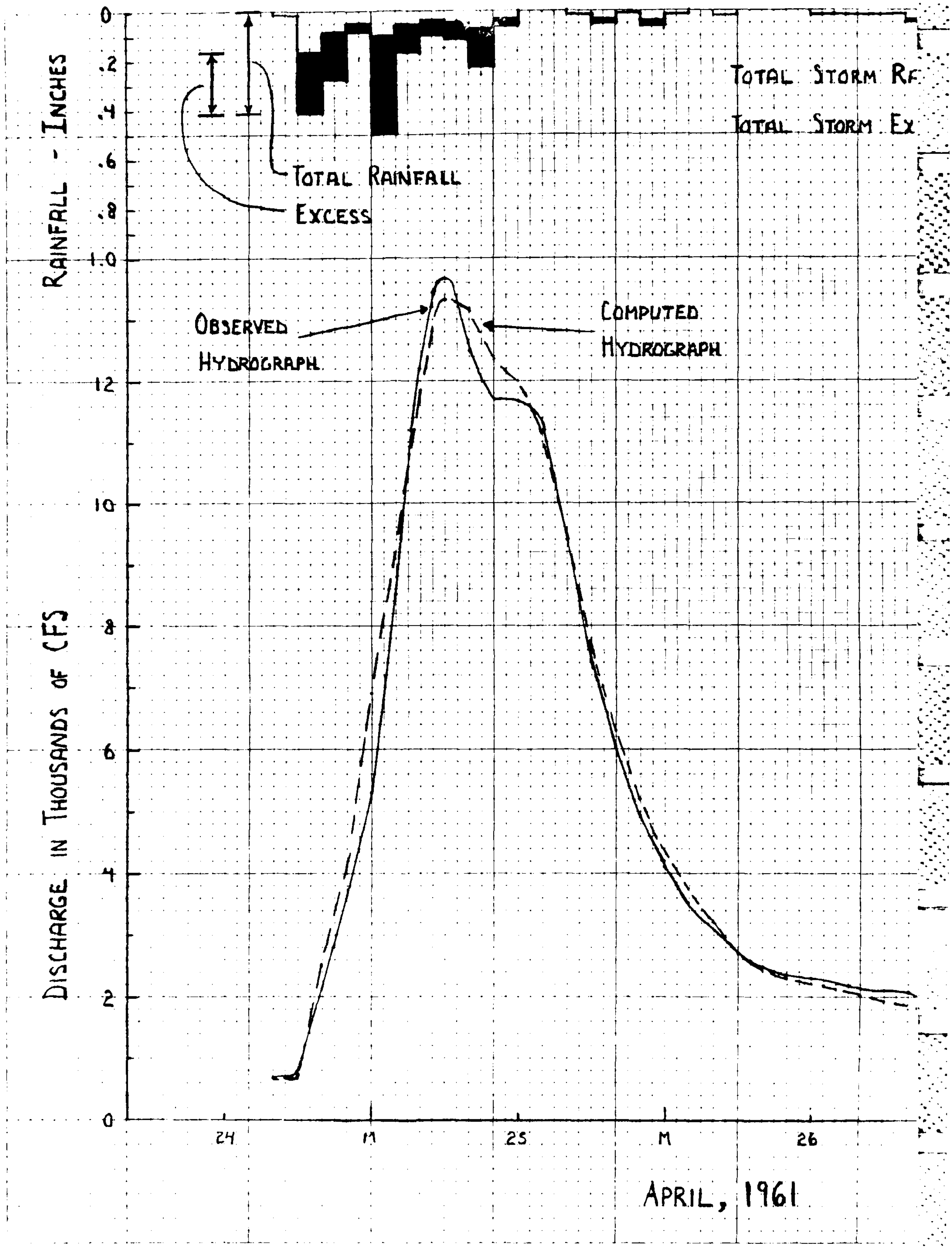
3-HOUR UNIT HYDROGRAPH

INFLOW TO MT. MORRIS DAM

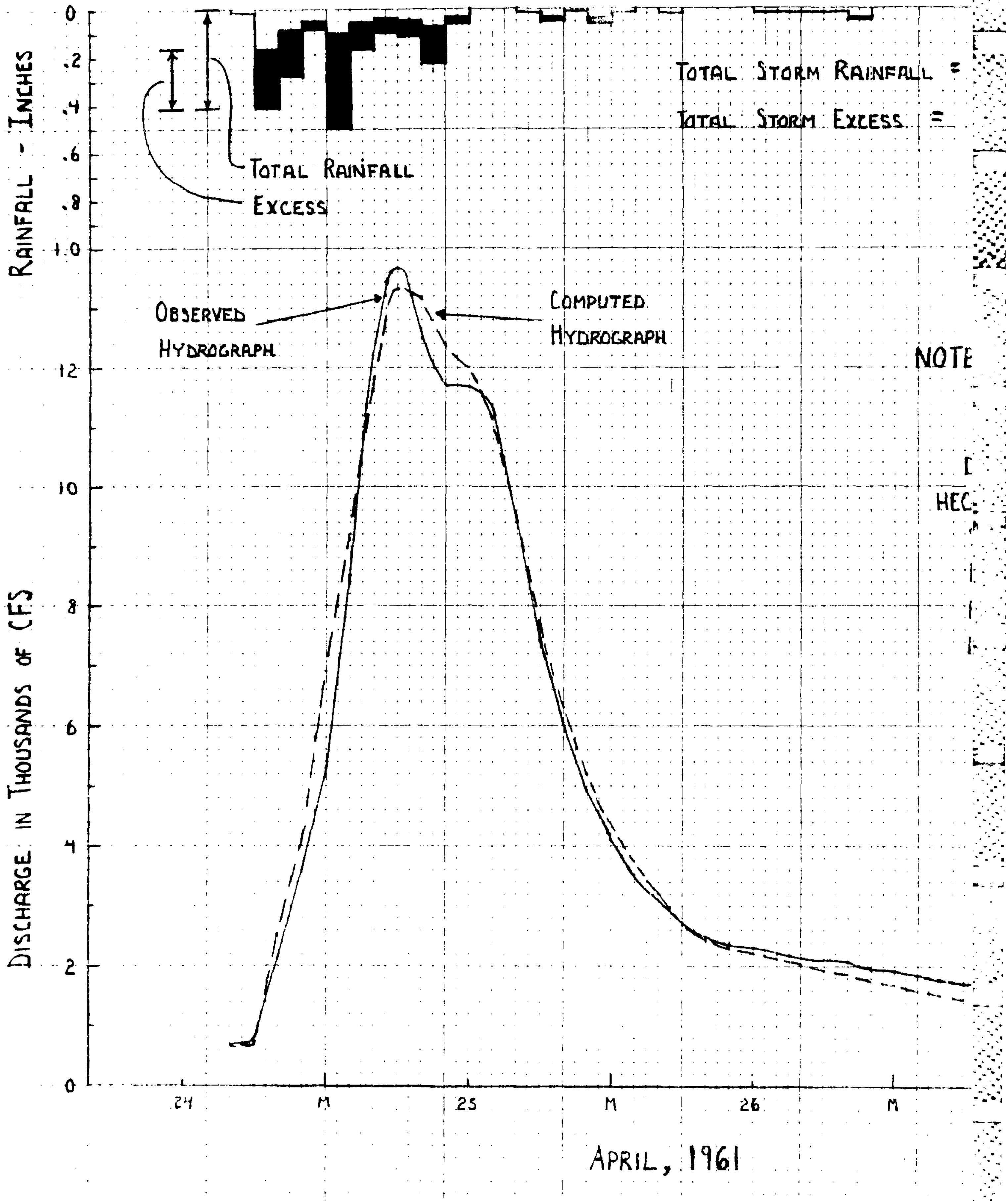
U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A12

2



Rainfall - Inches
0
.2
.4
.6
.8
1.0
Total Rainfall
Excess
Total Storm Rf
Total Storm Ex
Observed Hydrograph
Computed Hydrograph
Discharge in Thousands of CFS
12
10
8
6
4
2
0
24
M
25
M
26
April, 1961



RAINFALL - INCHES
0
.2
.4
.6
.8
1.0
TOTAL RAINFALL
EXCESS
TOTAL STORM RAINFALL =
TOTAL STORM EXCESS =
OBSERVED HYDROGRAPH
COMPUTED HYDROGRAPH
NOTE
HEC
DISCHARGE IN THOUSANDS OF CFS
12
10
8
6
4
2
0
24
M
25
M
26
M
APRIL, 1961

2

NFALL = 2.21 INCHES

ESS = 1.32 INCHES

NOTES:

Tc = 5.70 HOURS

R = 7.02 HOURS

D.A = 333. SQ MI

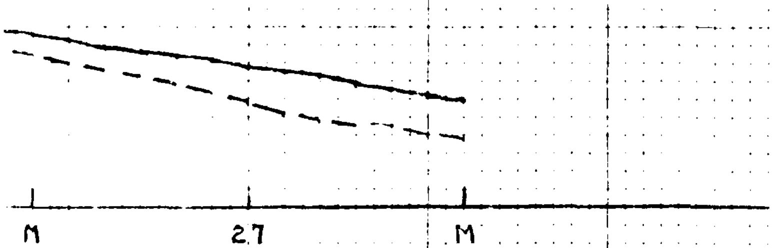
HEC-1 LOSS RATE PARAMETERS:

STRKR = 0.12

DLTKR = 0.32

RTIOL = 2.55

ERAIN = 0.50

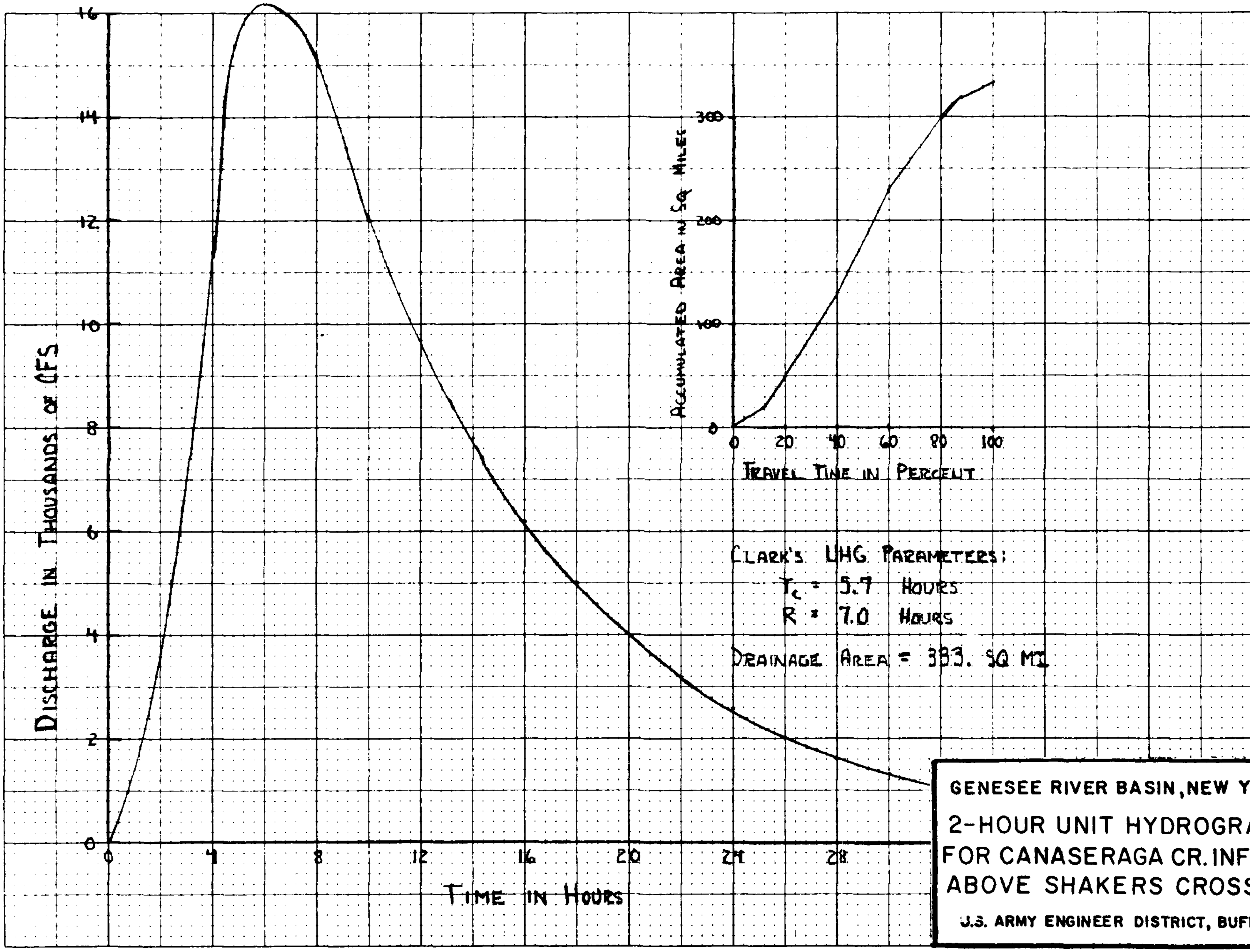


GENESEE RIVER BASIN, NEW YORK

INFLOW TO CANASERAGA CR. AT SHAKERS CROSSING APRIL 1961 FLOOD

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A13

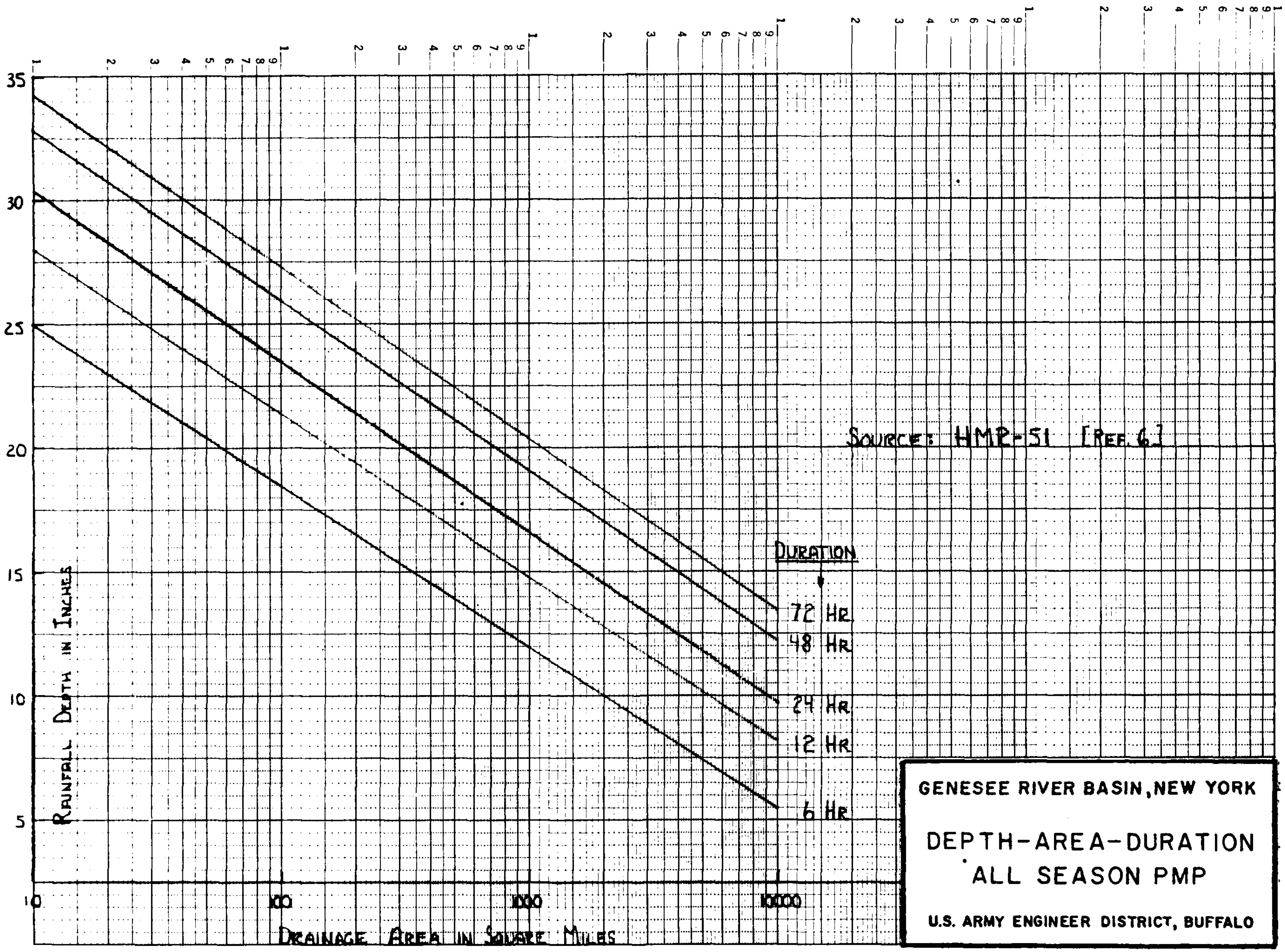


GENESEE RIVER BASIN, NEW YORK

2-HOUR UNIT HYDROGRAPH FOR CANASERAGA CR. INFLOW ABOVE SHAKERS CROSSING

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A14



GENESEE RIVER BASIN, NEW YORK

DEPTH-AREA-DURATION
ALL SEASON PMP

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A15

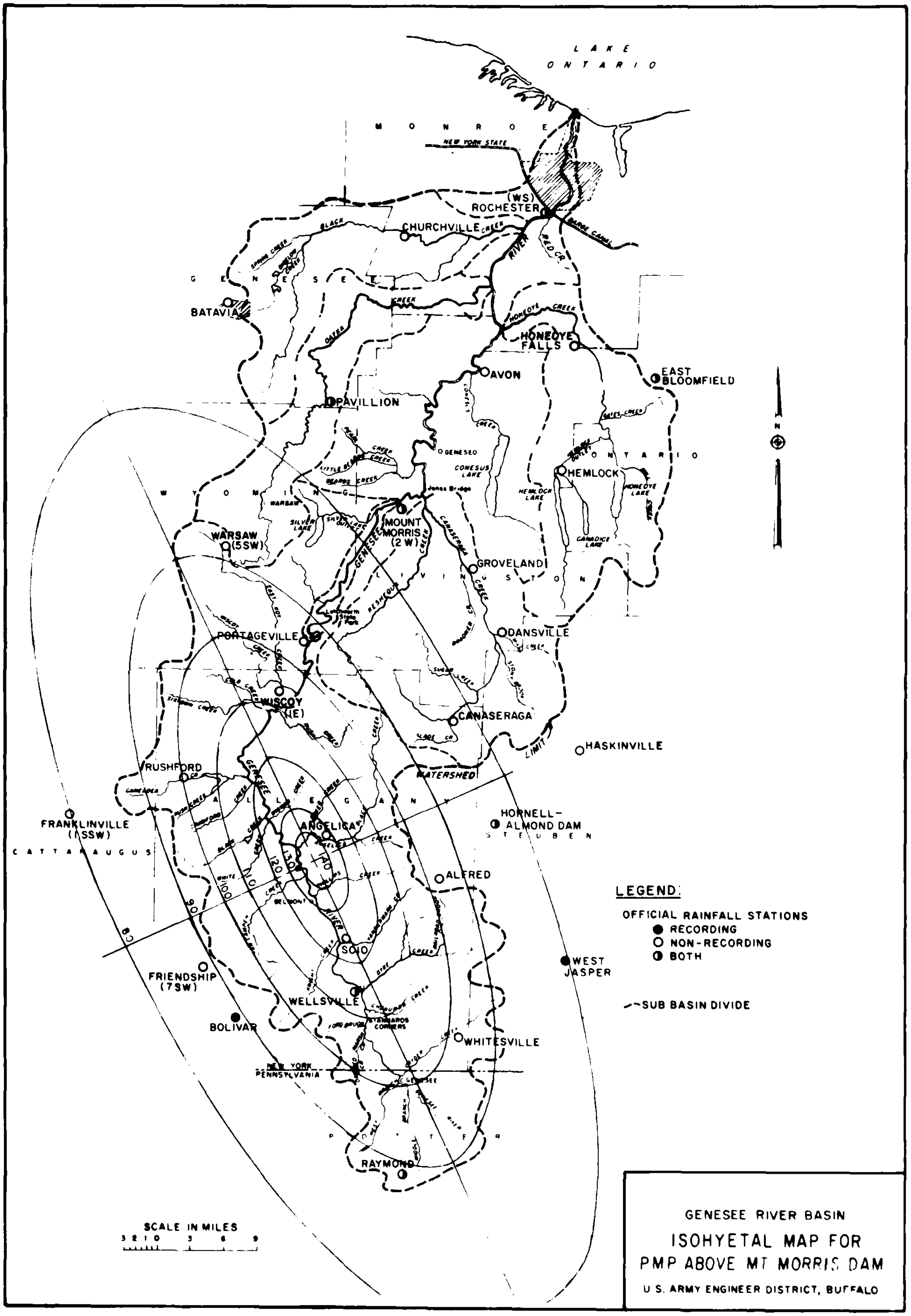
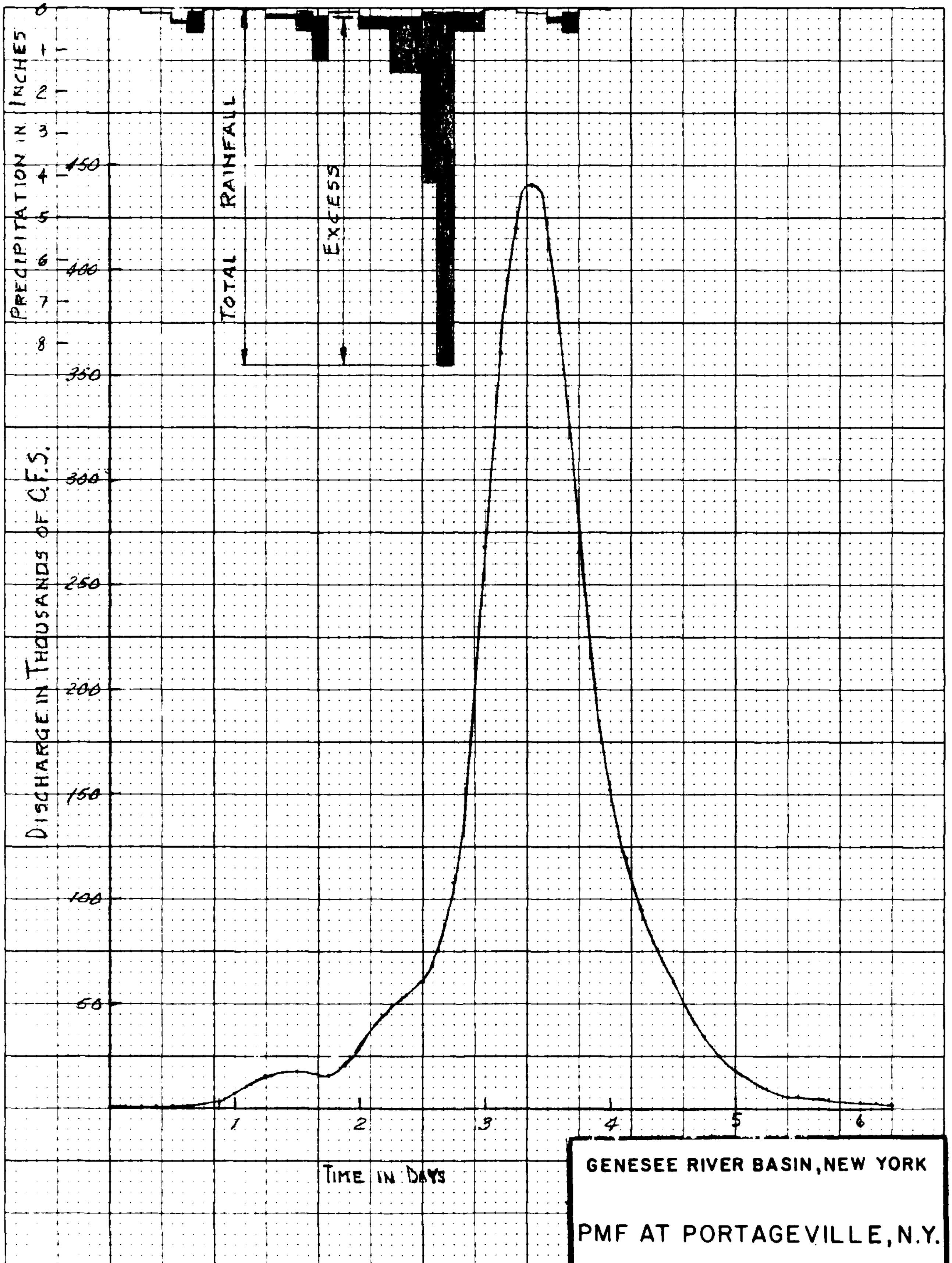

LAKE ONTARIO
MONROE
GENESEE
WYOMING
LIVINGSTON
ONTARIO
ALLEGANY
STEUBEN
CATTARAUGUS
POTTER
ROCHESTER (WS)
CHURCHVILLE
BATAVIA
HONEOYE FALLS
EAST BLOOMFIELD
AVON
PAVILLION
GENESEO
HEMLOCK
MOUNT MORRIS (2 W)
WARSAW (5SW)
GROVELAND
PORTAGEVILLE
DANSVILLE
WISCOY (1E)
CANASERAGA
HASKINVILLE
RUSHFORD
FRANKLINVILLE (15SW)
HORNELL-ALMOND DAM
ANGELICA
ALFRED
SCIO
FRIENDSHIP (7SW)
WEST JASPER
WELLSVILLE
BOLIVAR
WHITESVILLE
NEW YORK
PENNSYLVANIA
RAYMOND
WATERSHED
LIMIT
80
90
100
110
120
130
140
LEGEND:
OFFICIAL RAINFALL STATIONS
RECORDING
NON-RECORDING
BOTH
SUB BASIN DIVIDE
SCALE IN MILES
3 2 1 0 3 6 9
GENESEE RIVER BASIN
ISOHYETAL MAP FOR PMP ABOVE MT MORRIS DAM
U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A16

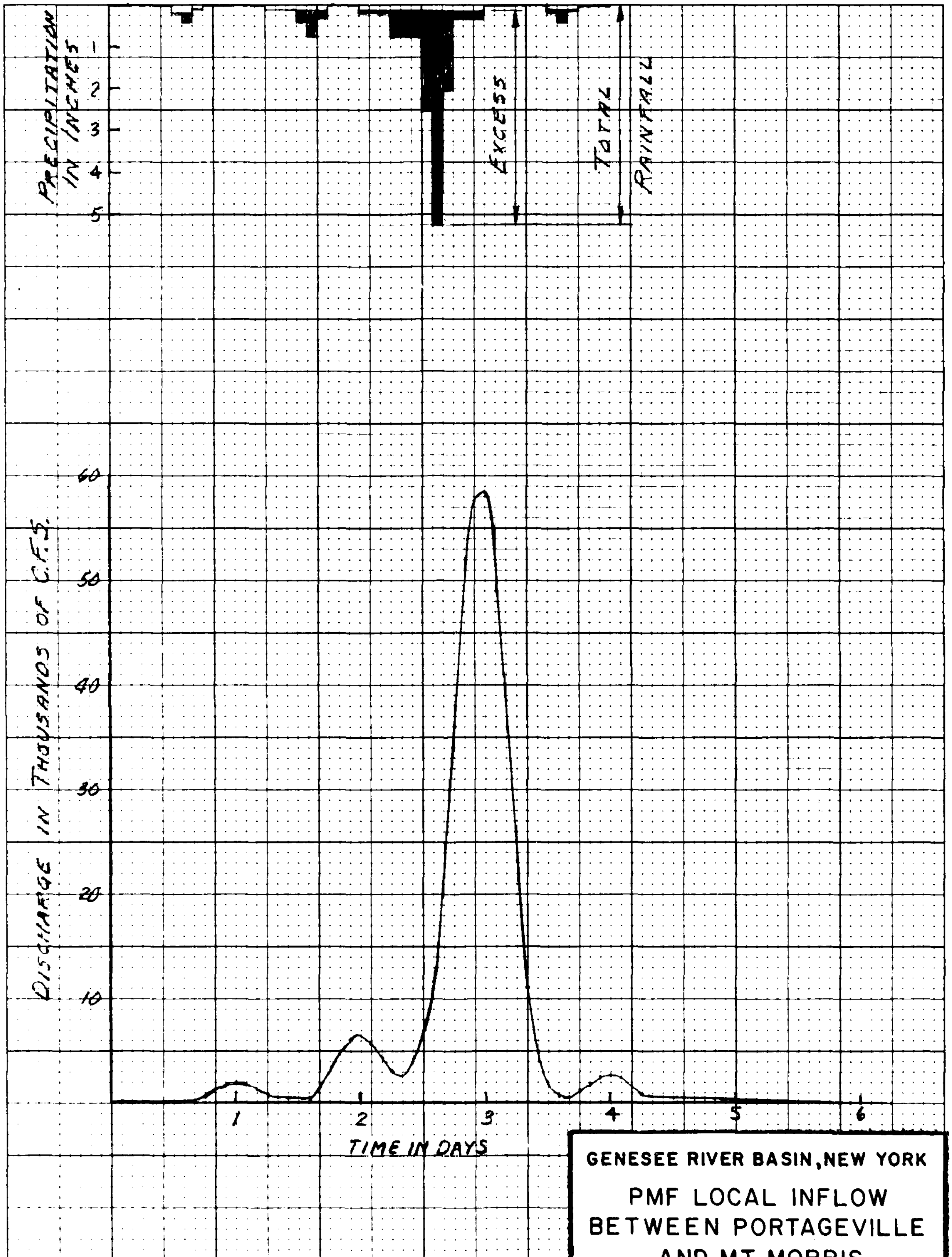


GENESEE RIVER BASIN, NEW YORK

PMF AT PORTAGEVILLE, N.Y.

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A17

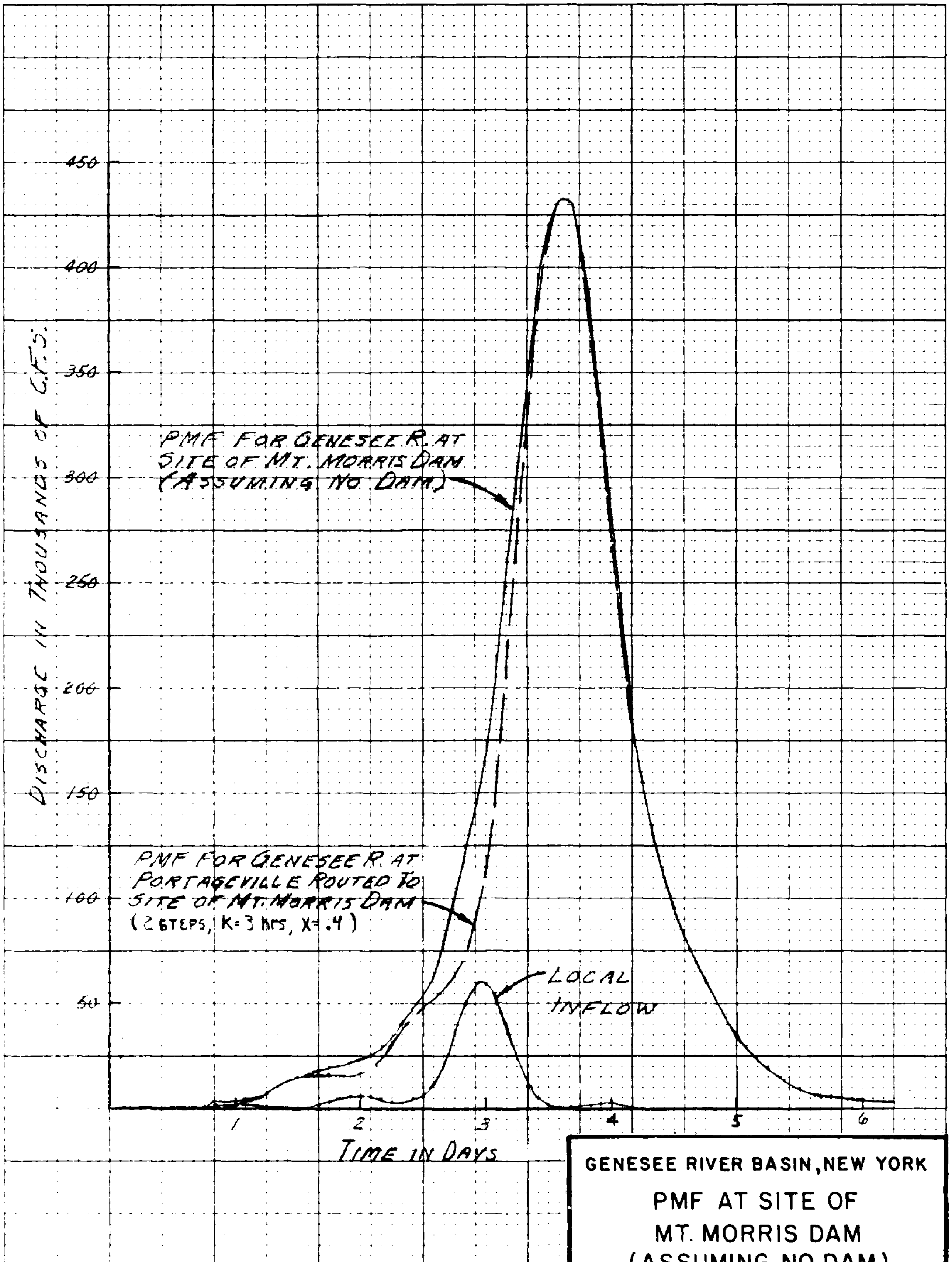


GENESEE RIVER BASIN, NEW YORK

PMF LOCAL INFLOW BETWEEN PORTAGEVILLE AND MT. MORRIS

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A18

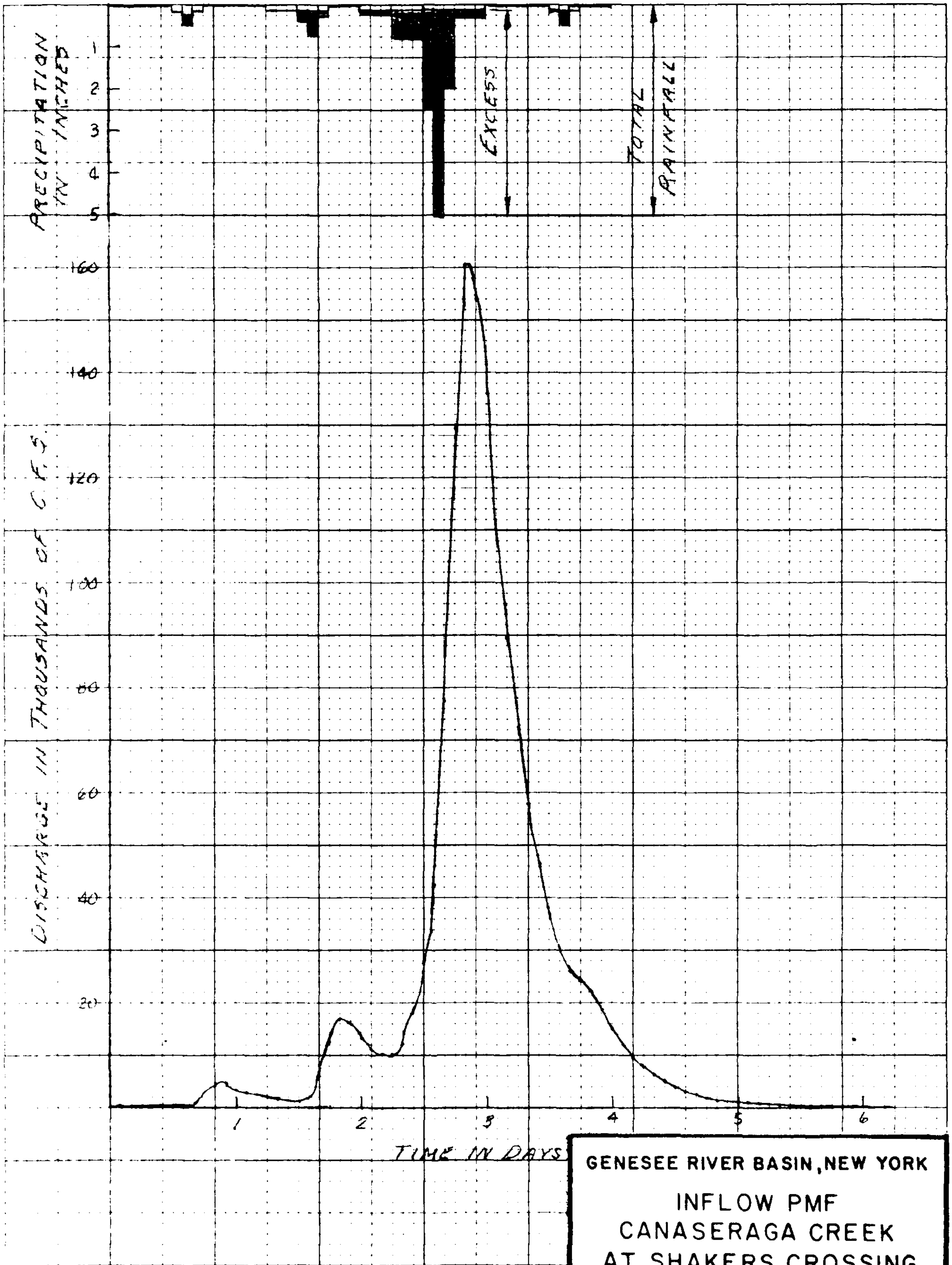


GENESEE RIVER BASIN, NEW YORK

PMF AT SITE OF
MT. MORRIS DAM
(ASSUMING NO DAM)

U.S. ARMY ENGINEER DISTRICT, BUFFALO

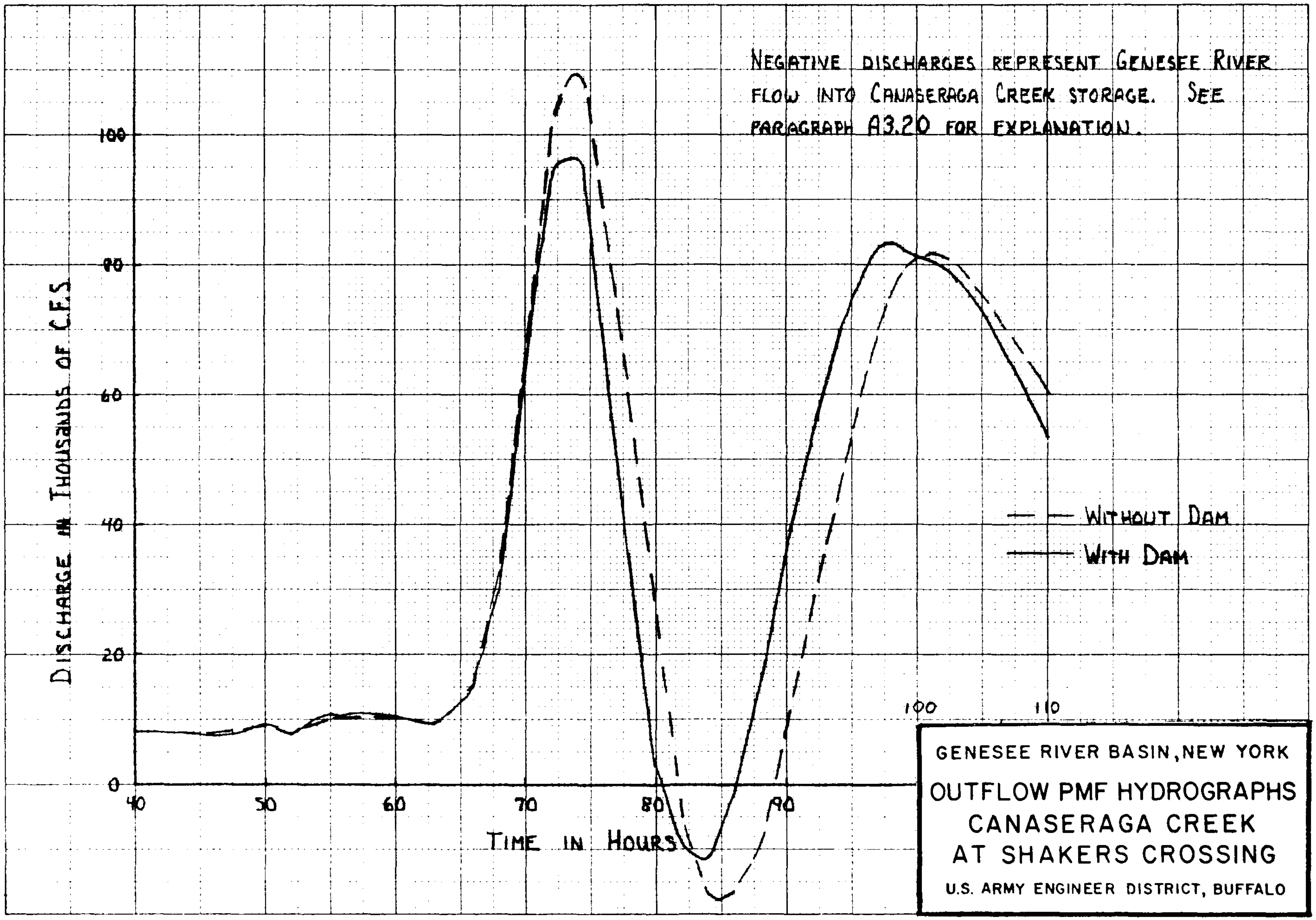
PLATE A18A



GENESEE RIVER BASIN, NEW YORK

INFLOW PMF
CANASERAGA CREEK
AT SHAKERS CROSSING

U.S. ARMY ENGINEER DISTRICT, BUFFALO

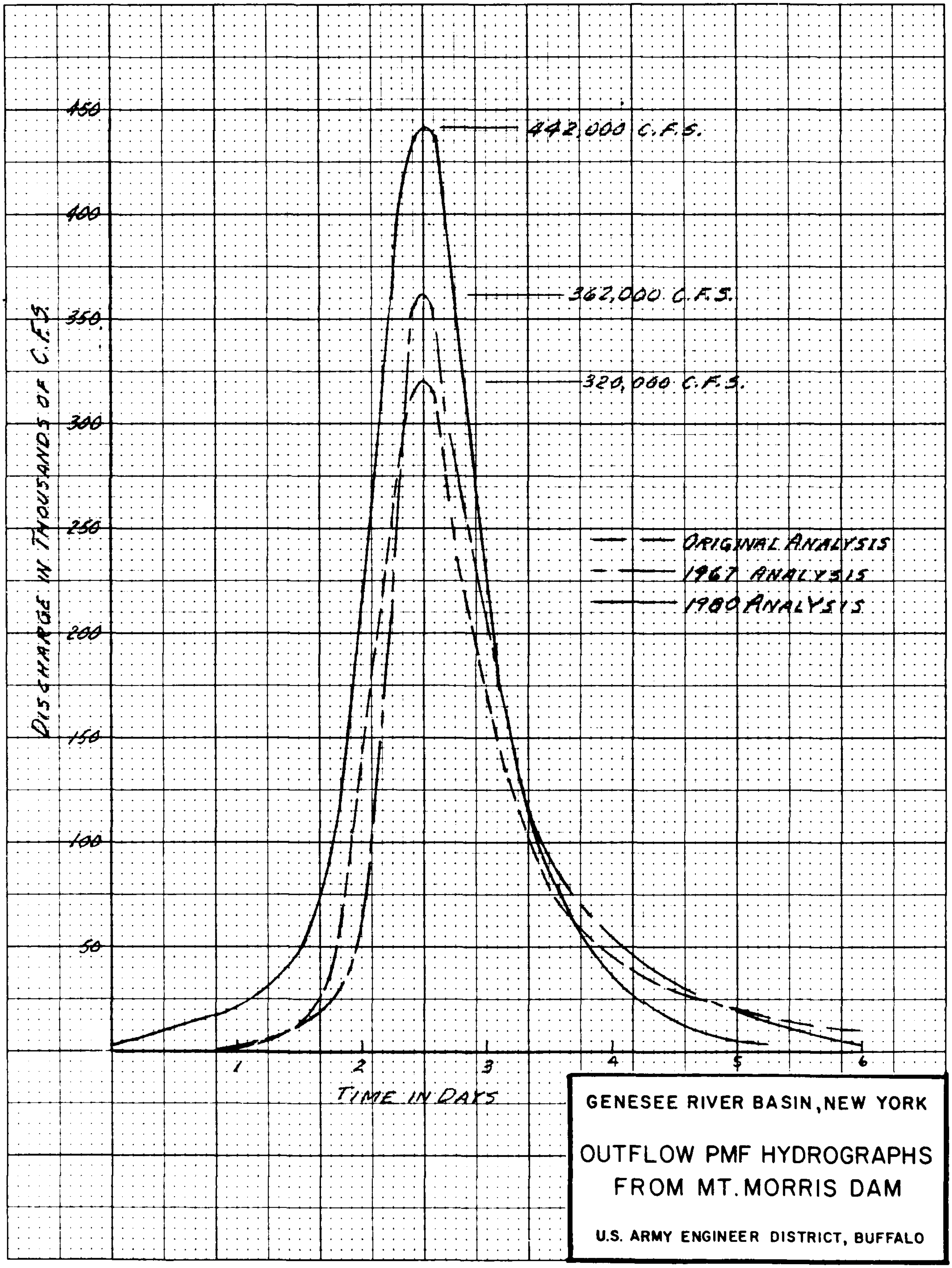


GENESEE RIVER BASIN, NEW YORK

OUTFLOW PMF HYDROGRAPHS
CANASERAGA CREEK
AT SHAKERS CROSSING

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A20

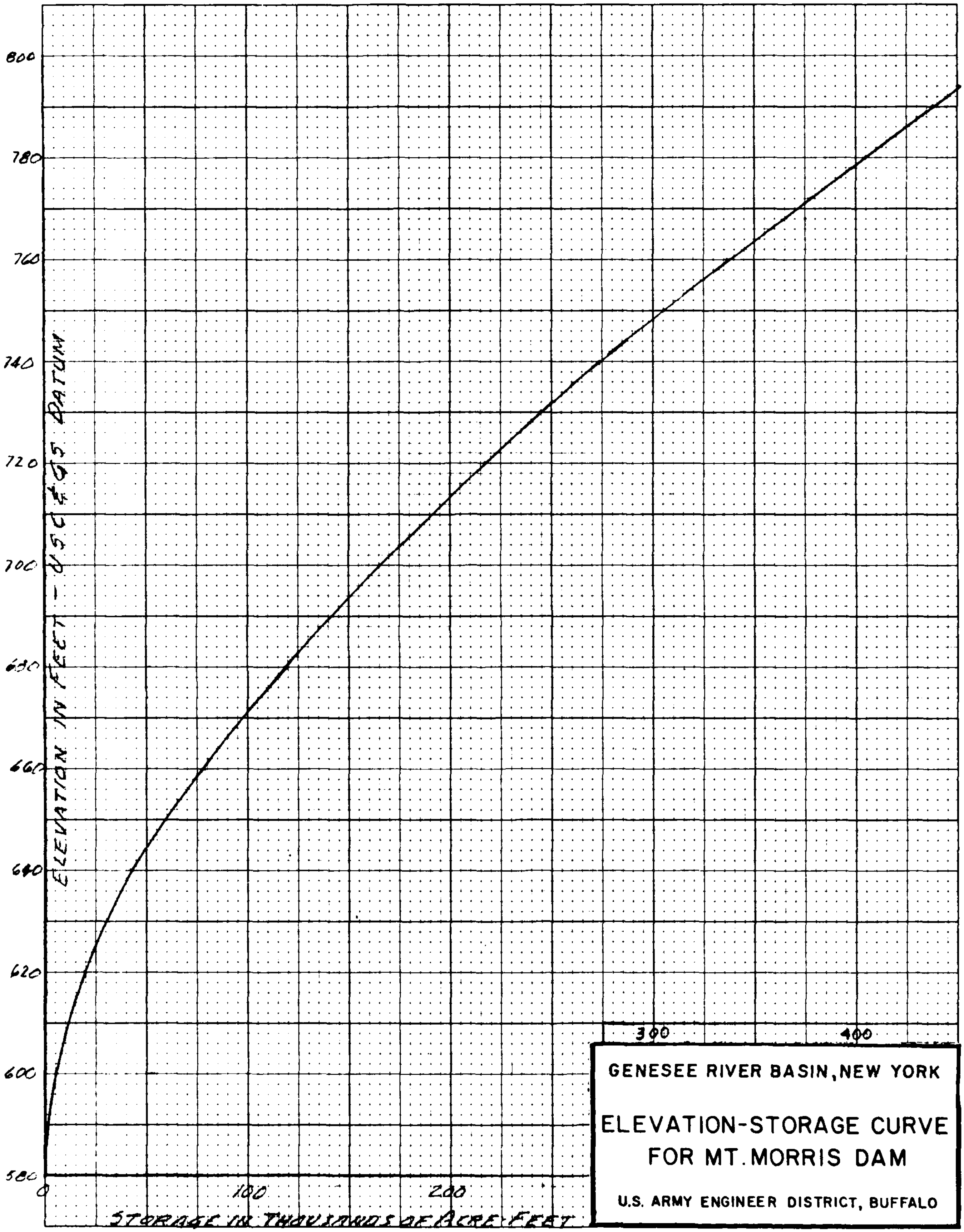


GENESEE RIVER BASIN, NEW YORK

OUTFLOW PMF HYDROGRAPHS
FROM MT. MORRIS DAM

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A21

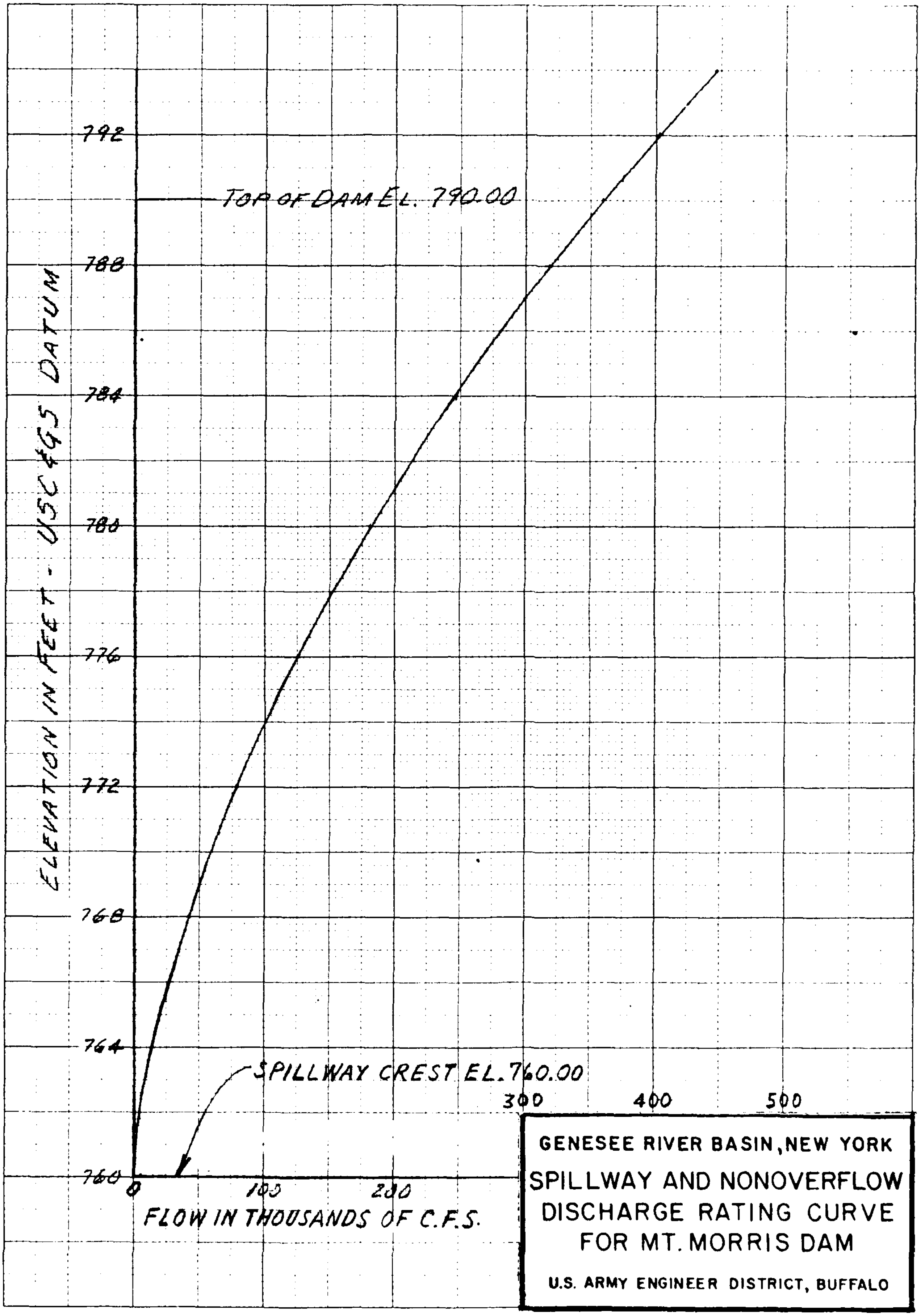


GENESEE RIVER BASIN, NEW YORK

ELEVATION-STORAGE CURVE FOR MT. MORRIS DAM

U.S. ARMY ENGINEER DISTRICT, BUFFALO

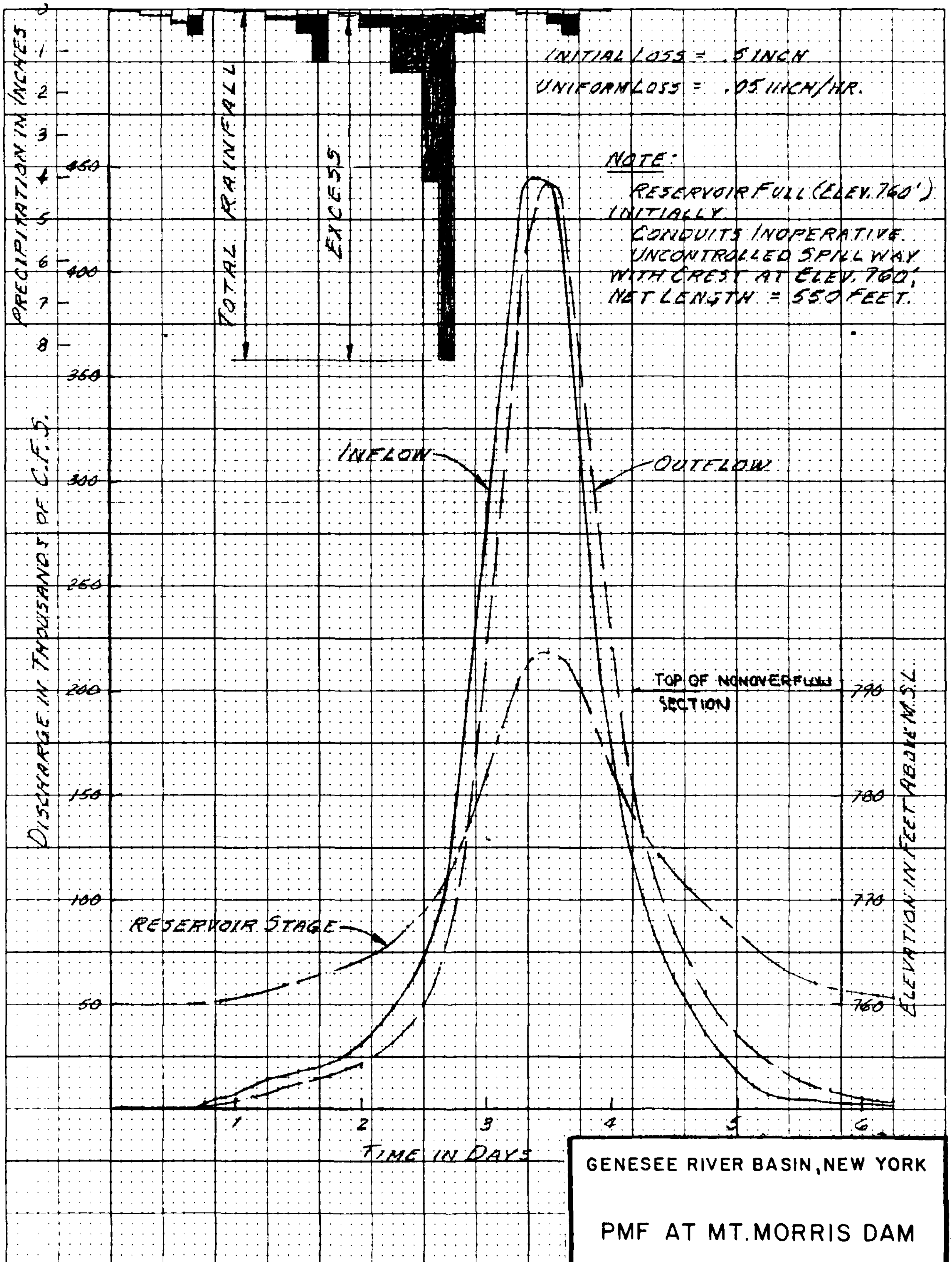
PLATE A22



GENESEE RIVER BASIN, NEW YORK

SPILLWAY AND NONOVERFLOW DISCHARGE RATING CURVE FOR MT. MORRIS DAM

U.S. ARMY ENGINEER DISTRICT, BUFFALO

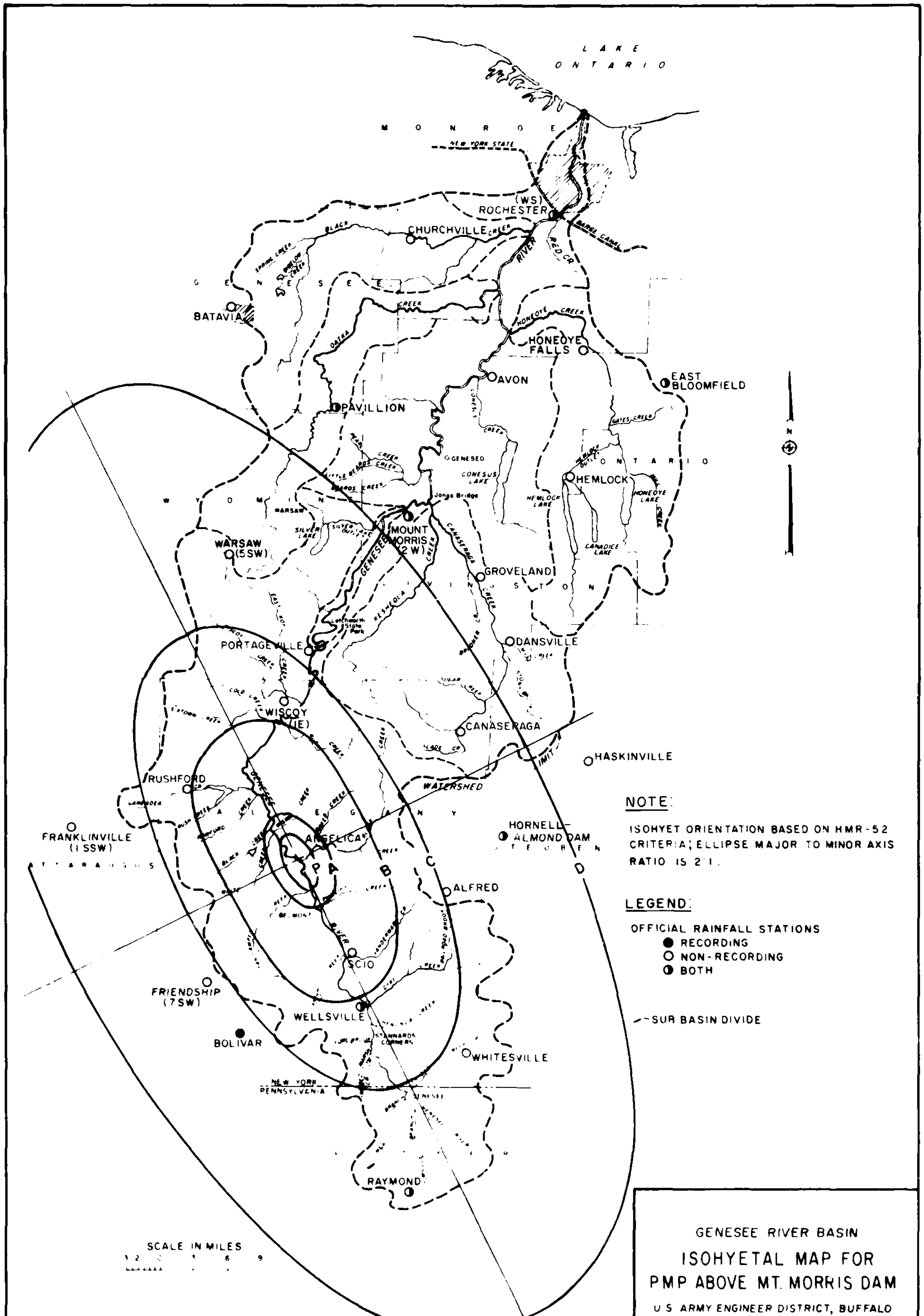


GENESEE RIVER BASIN, NEW YORK

PMF AT MT. MORRIS DAM

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A24

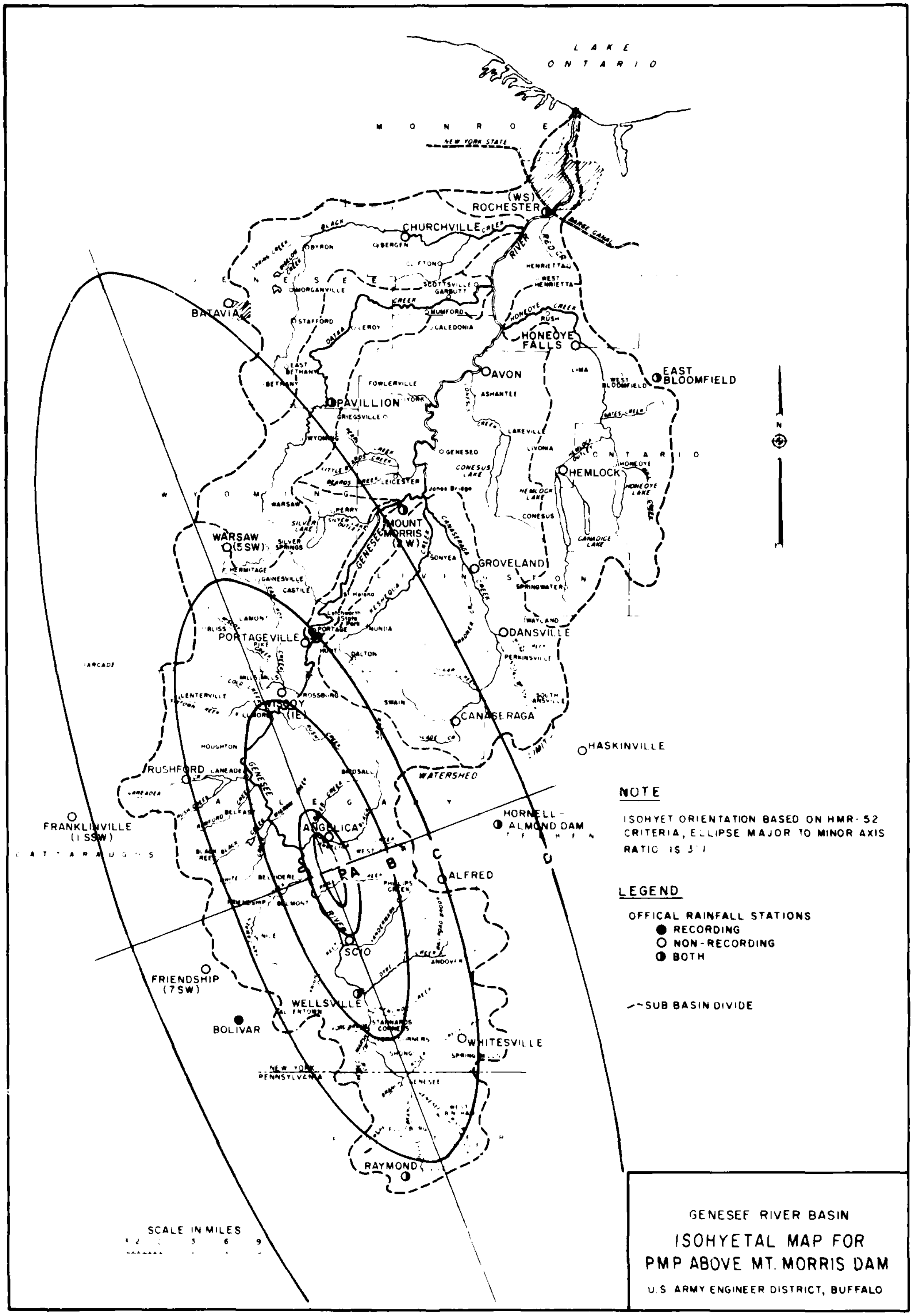


GENESEE RIVER BASIN

ISOHYETAL MAP FOR PMP ABOVE MT. MORRIS DAM

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A25

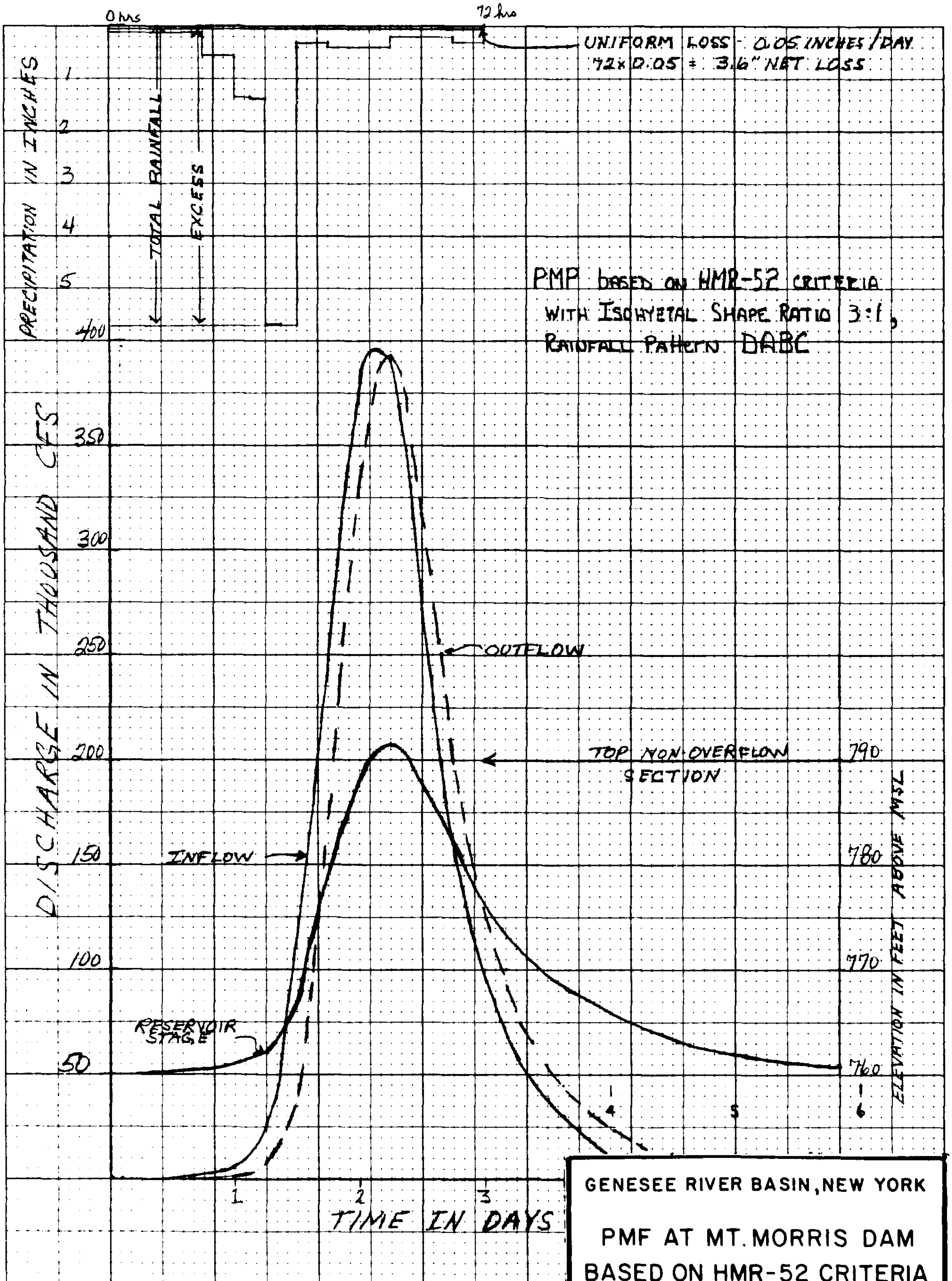


GENESEE RIVER BASIN

ISOHYETAL MAP FOR PMP ABOVE MT. MORRIS DAM

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A26

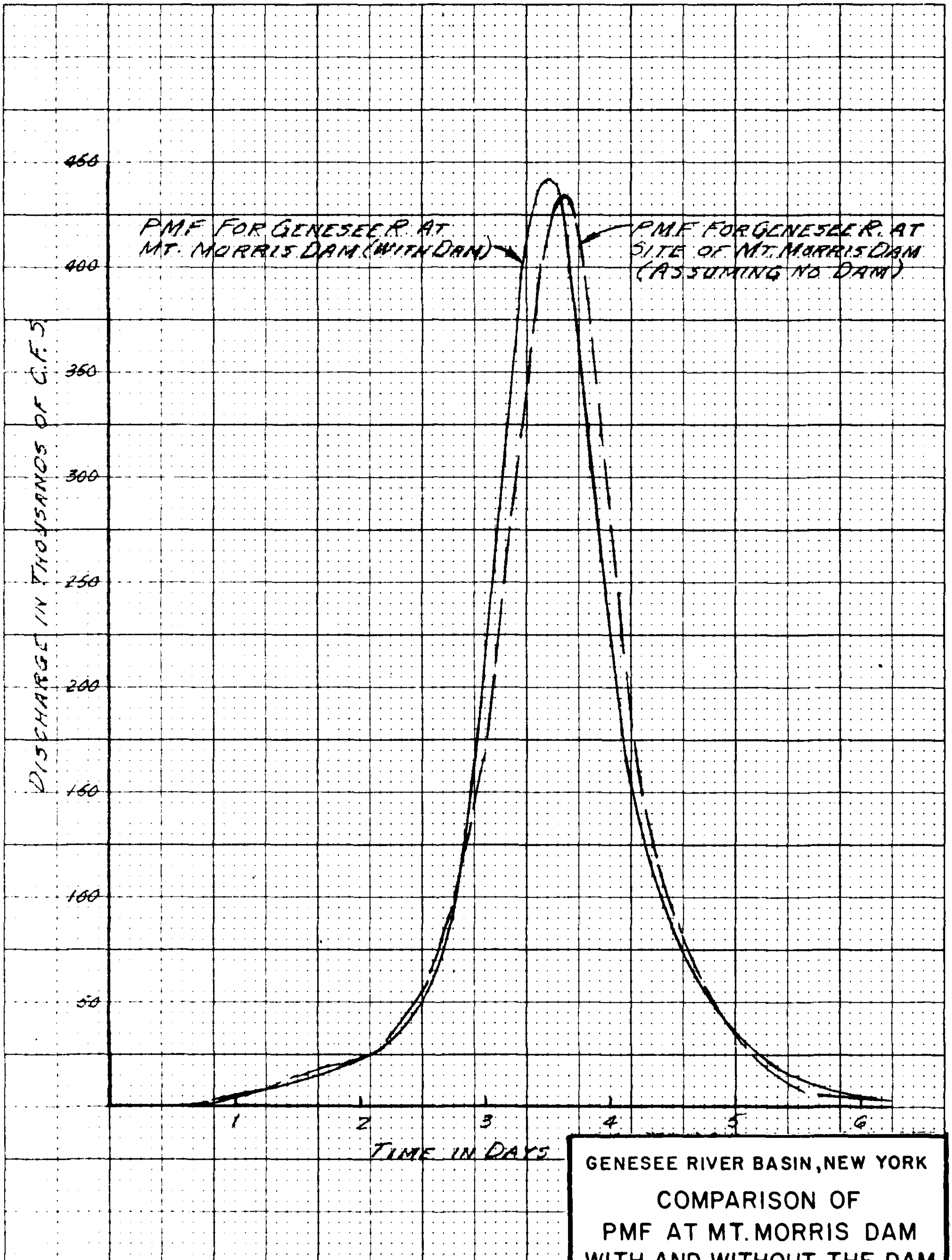


GENESEE RIVER BASIN, NEW YORK

PMF AT MT. MORRIS DAM
BASED ON HMR-52 CRITERIA

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A27

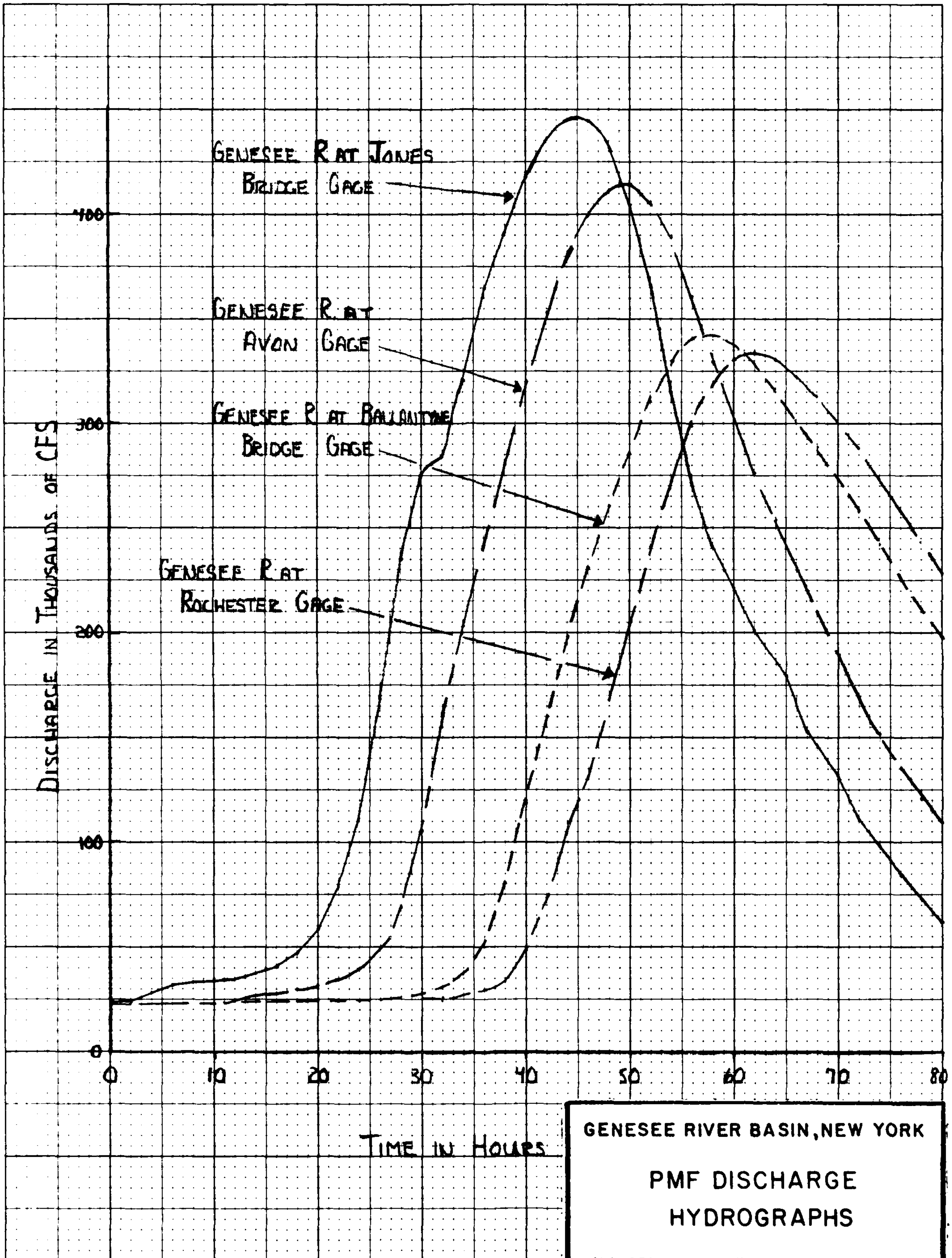


GENESEE RIVER BASIN, NEW YORK

COMPARISON OF
PMF AT MT. MORRIS DAM
WITH AND WITHOUT THE DAM

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A28

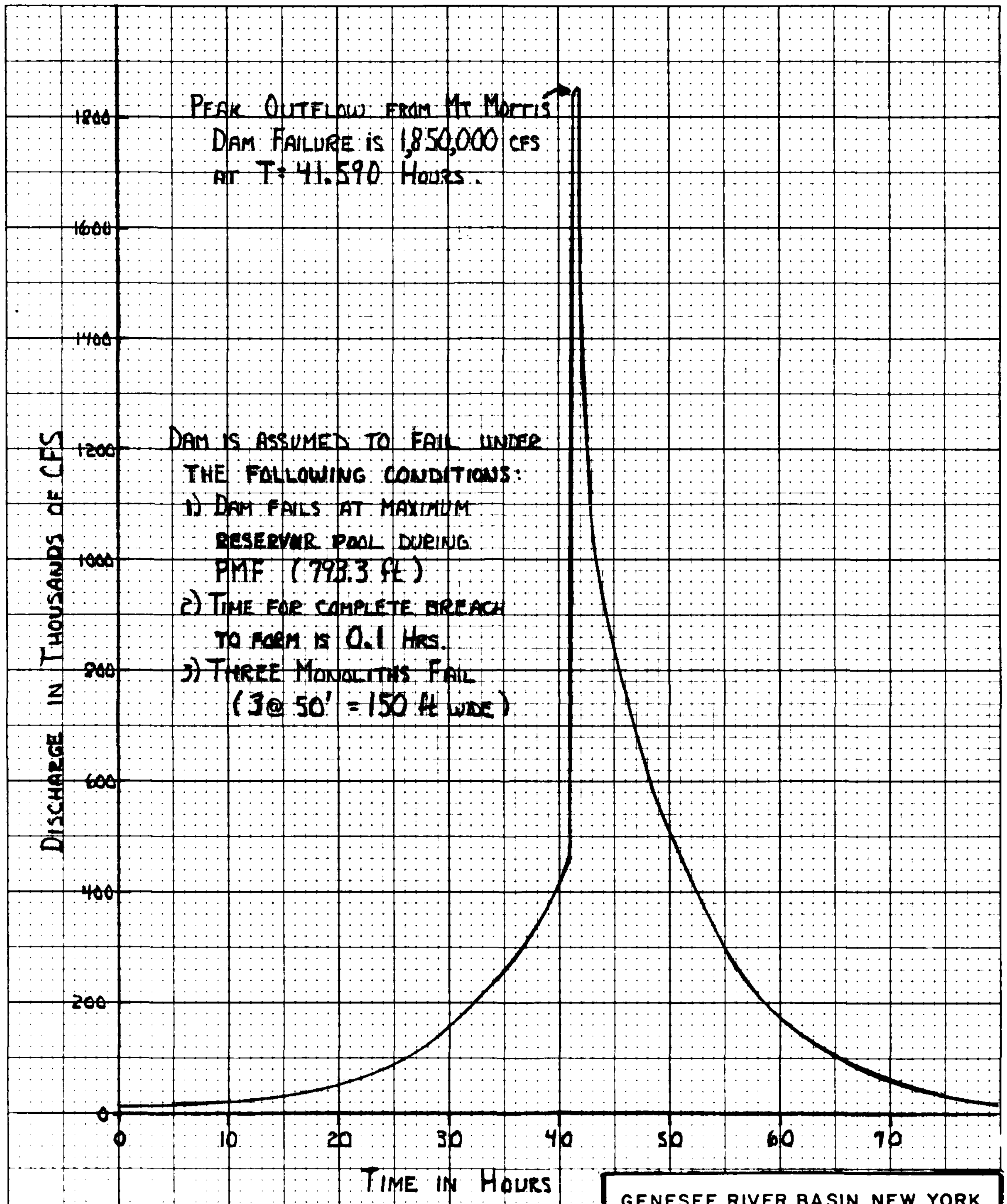


GENESEE RIVER BASIN, NEW YORK

PMF DISCHARGE HYDROGRAPHS

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A29

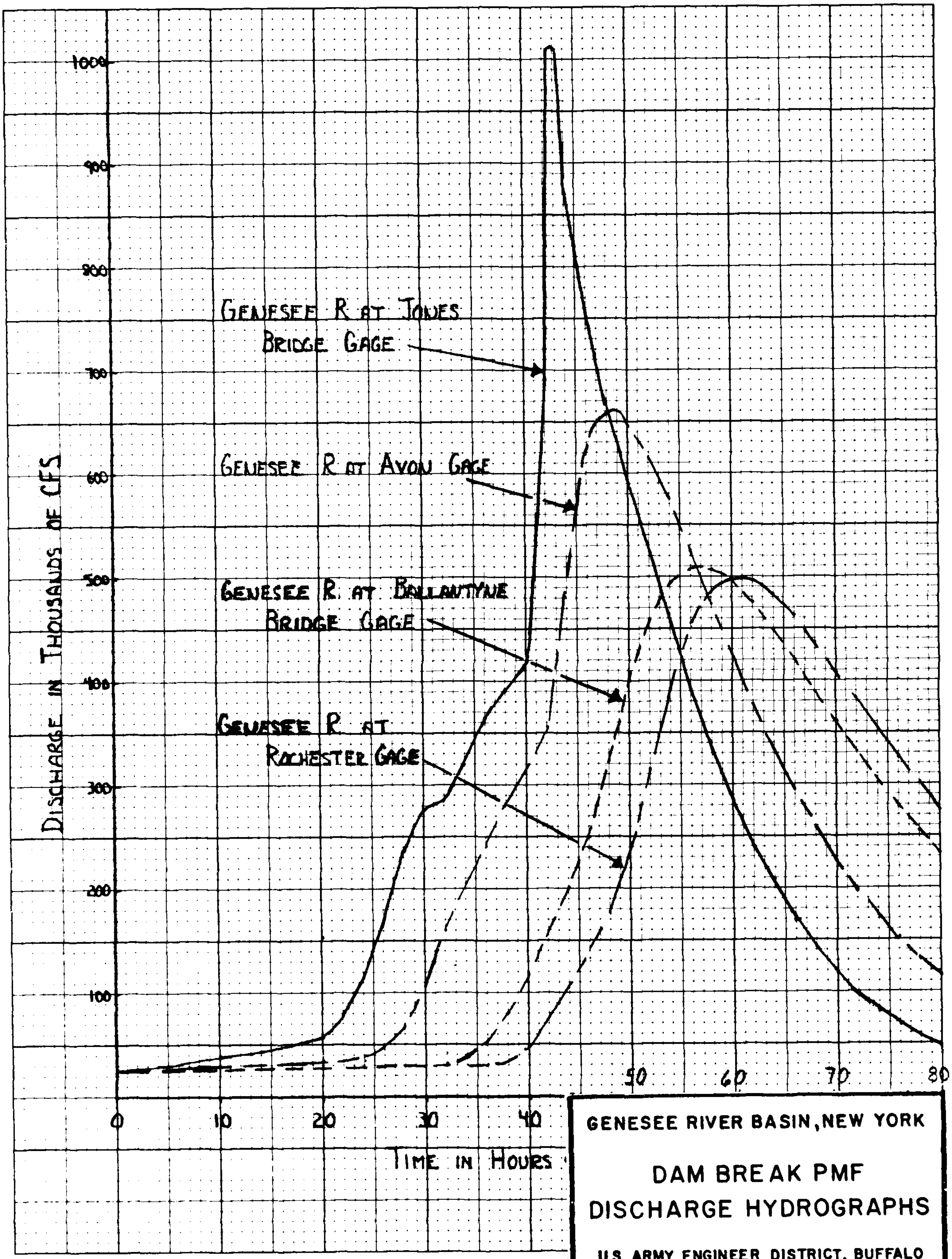


GENESEE RIVER BASIN, NEW YORK

DAM BREAK PMF OUTFLOW HYDROGRAPH FROM MT. MORRIS DAM

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A30

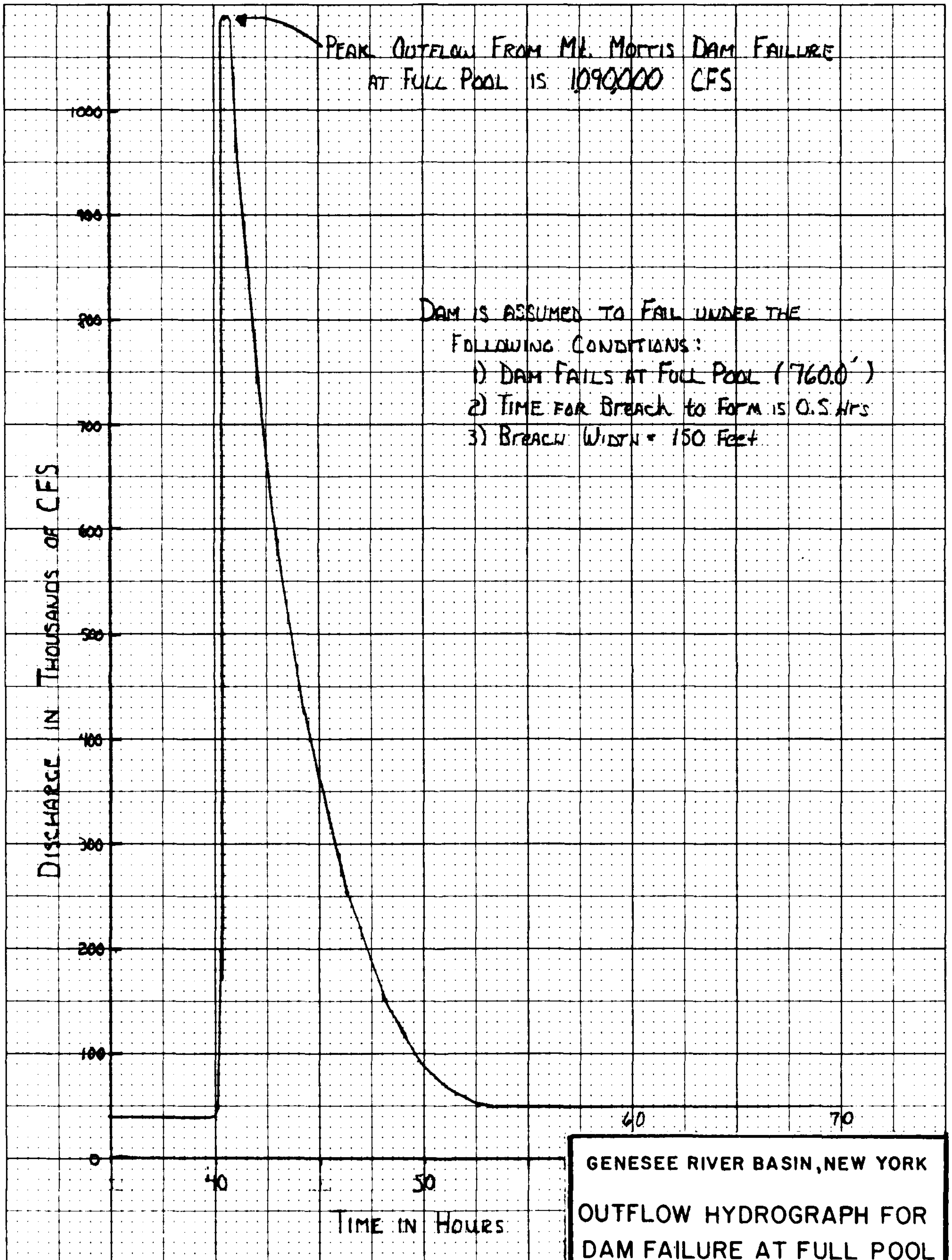


GENESEE RIVER BASIN, NEW YORK

DAM BREAK PMF
DISCHARGE HYDROGRAPHS

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A31

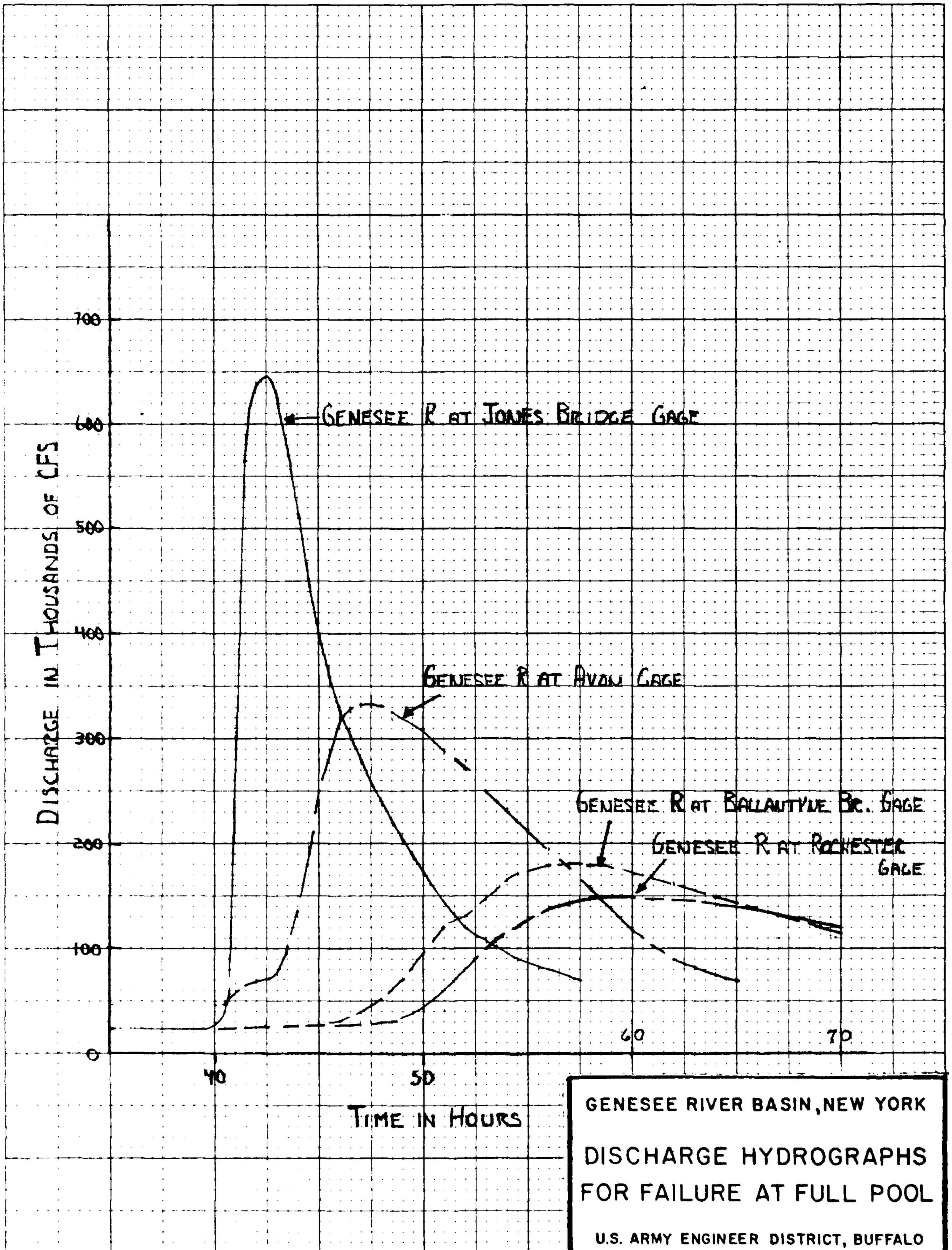


GENESEE RIVER BASIN, NEW YORK

OUTFLOW HYDROGRAPH FOR DAM FAILURE AT FULL POOL

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A32

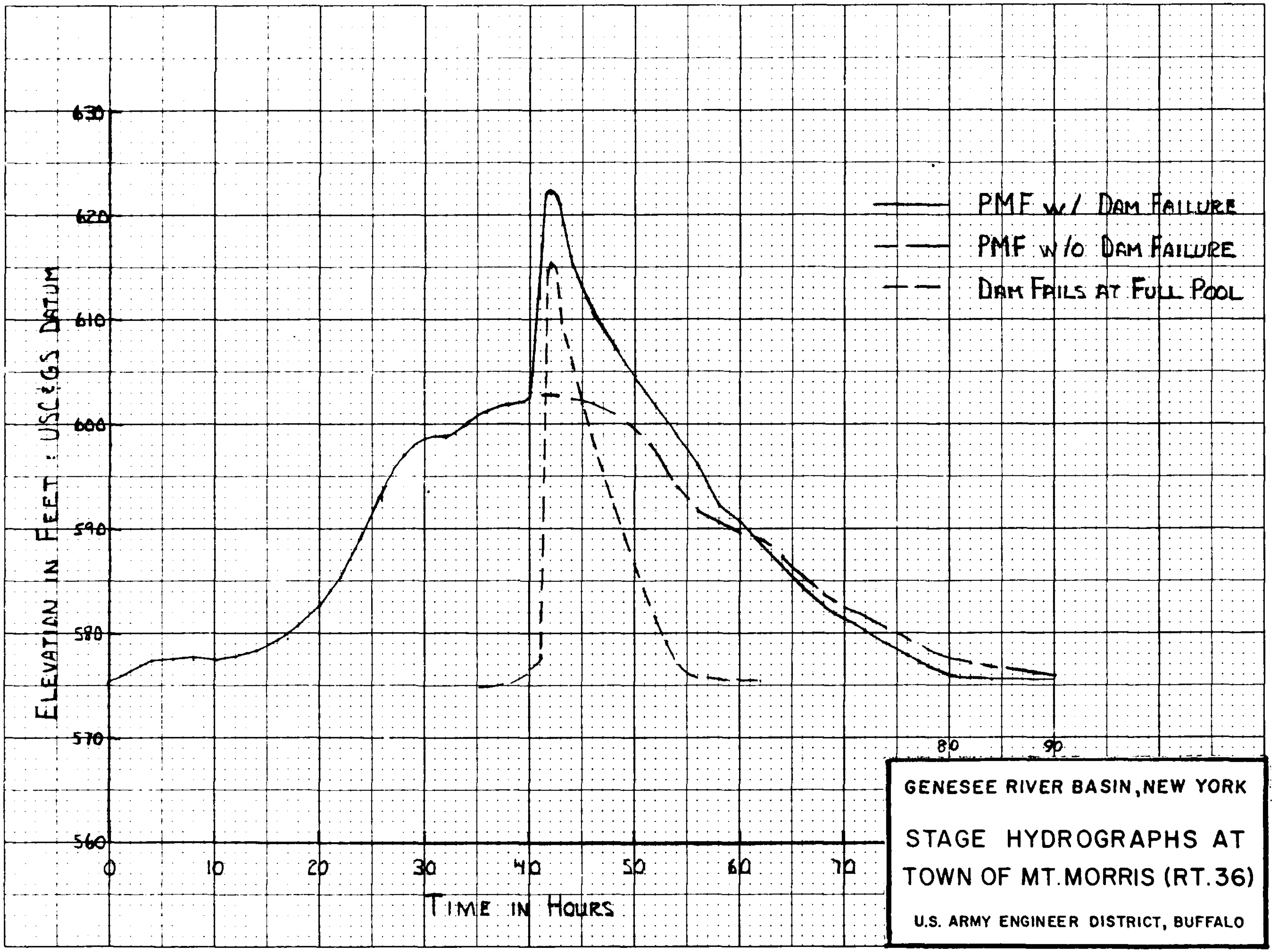


GENESEE RIVER BASIN, NEW YORK

DISCHARGE HYDROGRAPHS FOR FAILURE AT FULL POOL

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A33

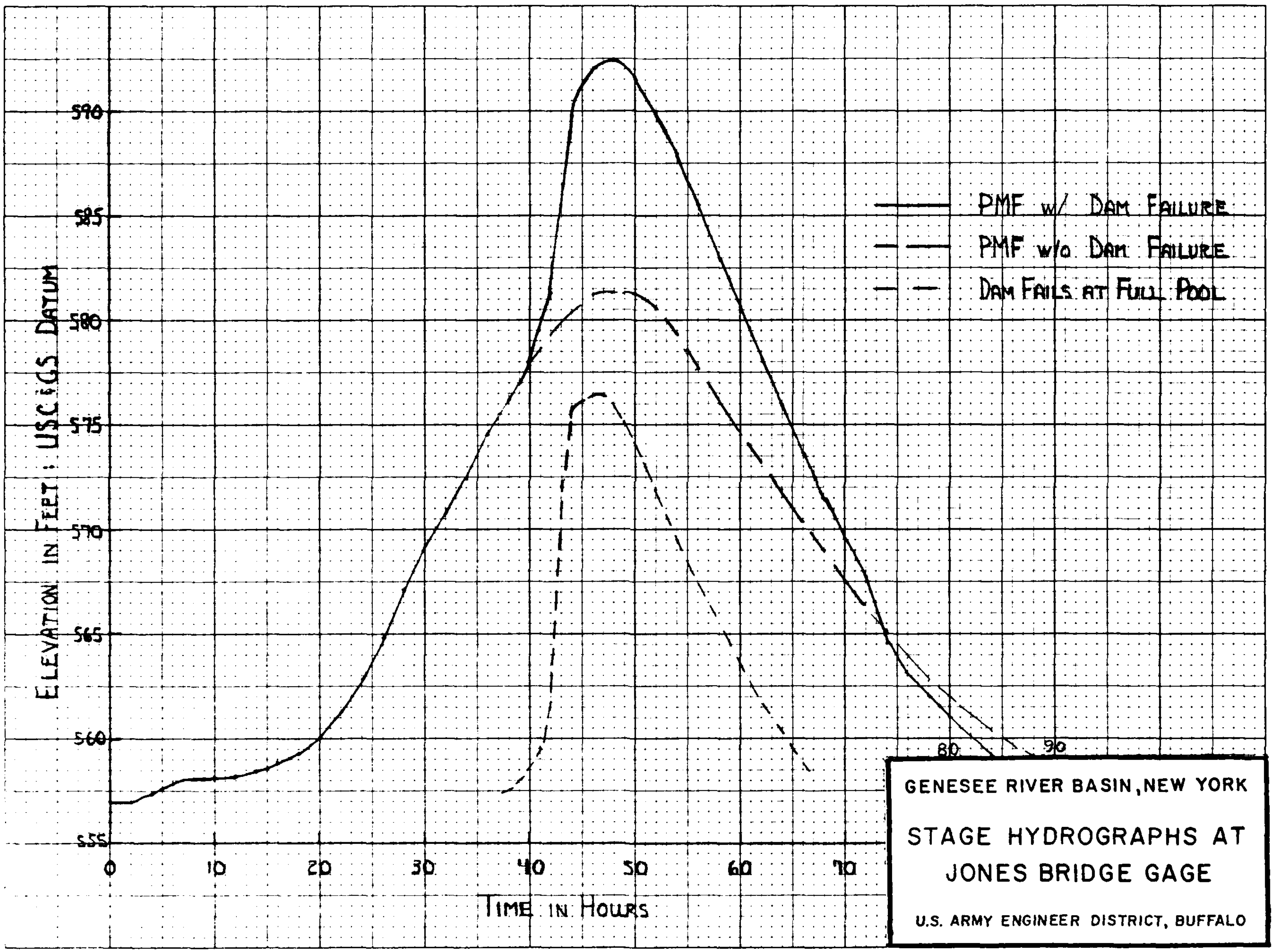


GENESEE RIVER BASIN, NEW YORK

STAGE HYDROGRAPHS AT TOWN OF MT. MORRIS (RT. 36)

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A34

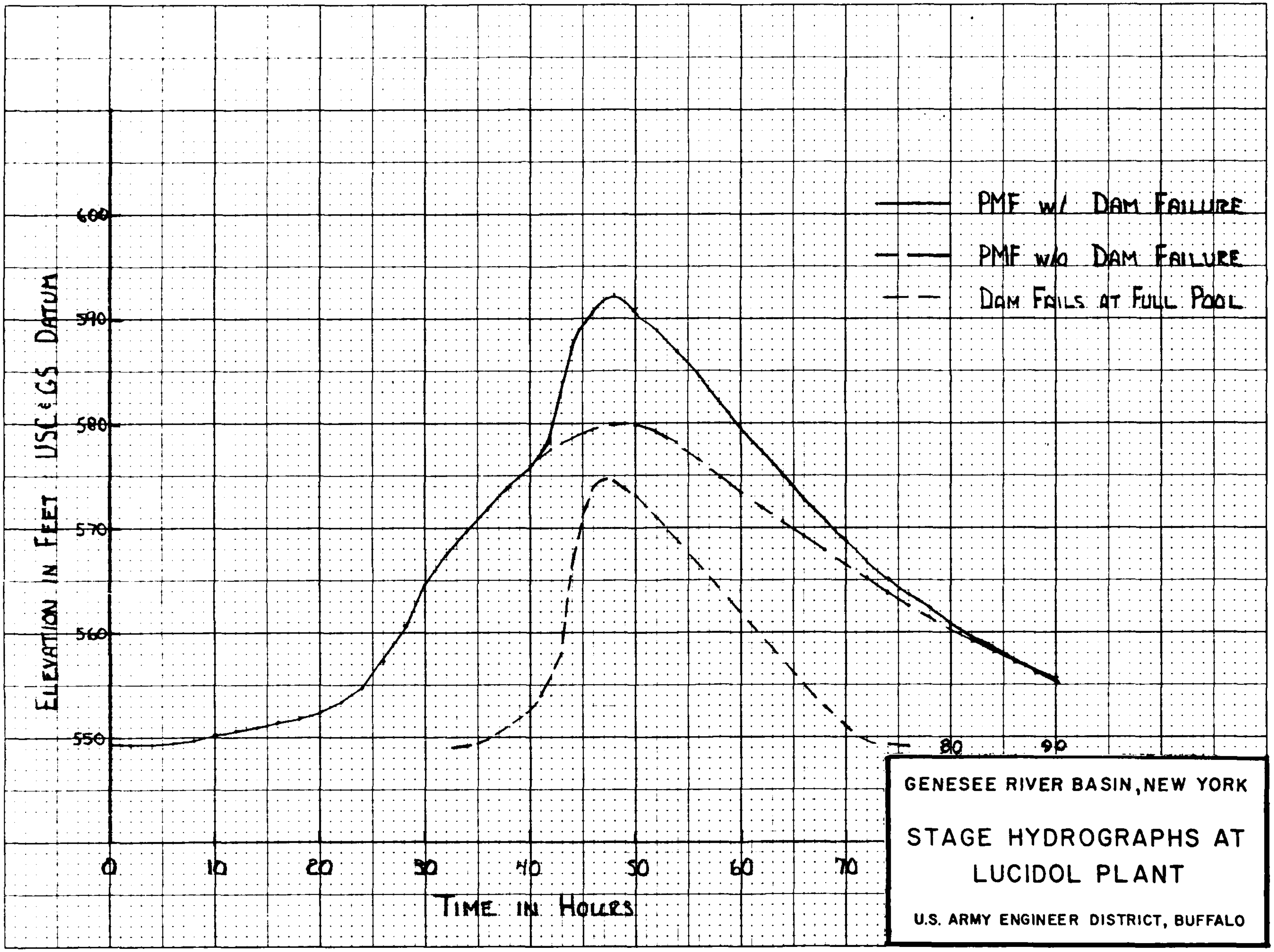


GENESEE RIVER BASIN, NEW YORK

STAGE HYDROGRAPHS AT JONES BRIDGE GAGE

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A35

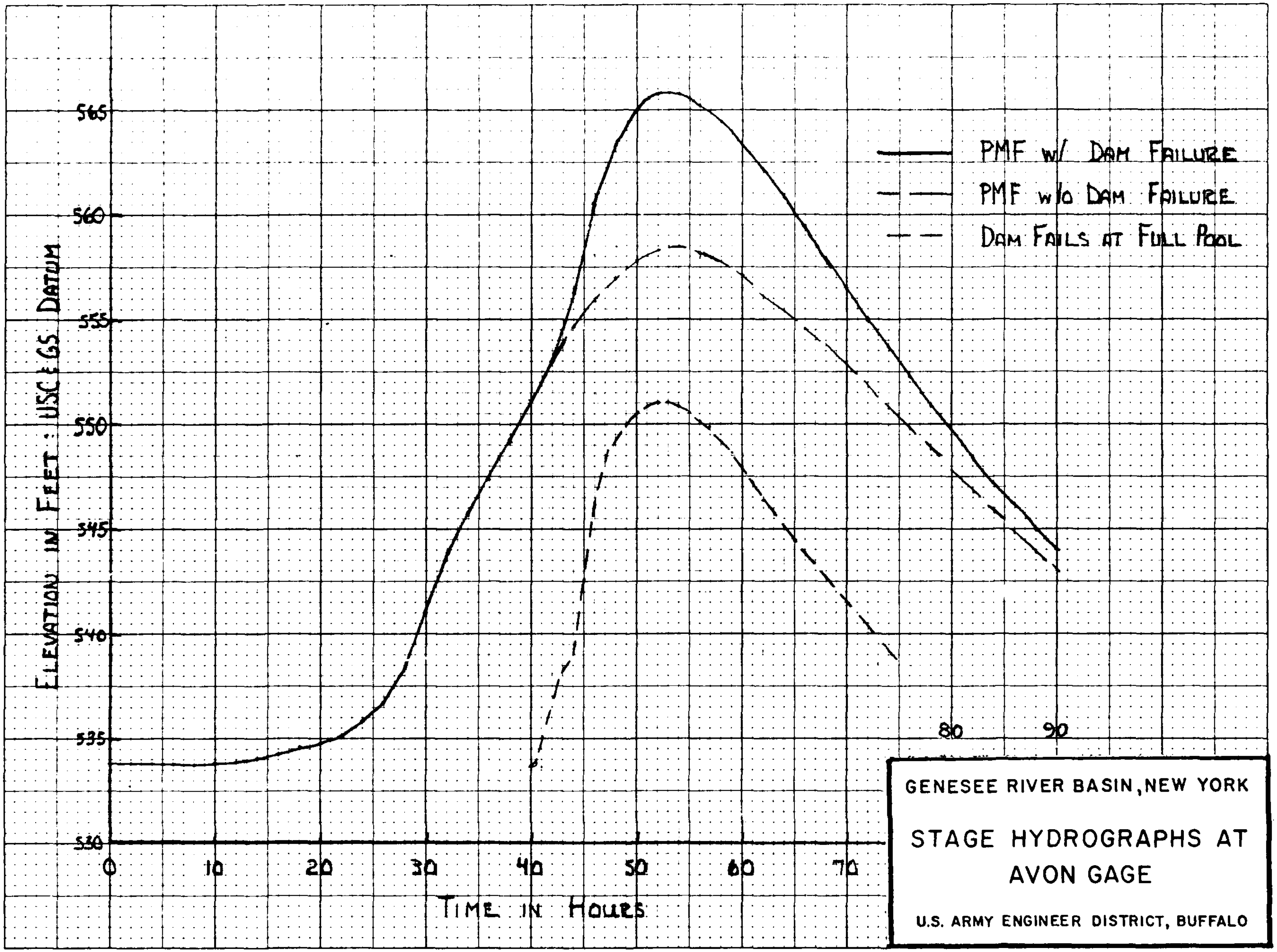


GENESEE RIVER BASIN, NEW YORK

STAGE HYDROGRAPHS AT LUCIDOL PLANT

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A36

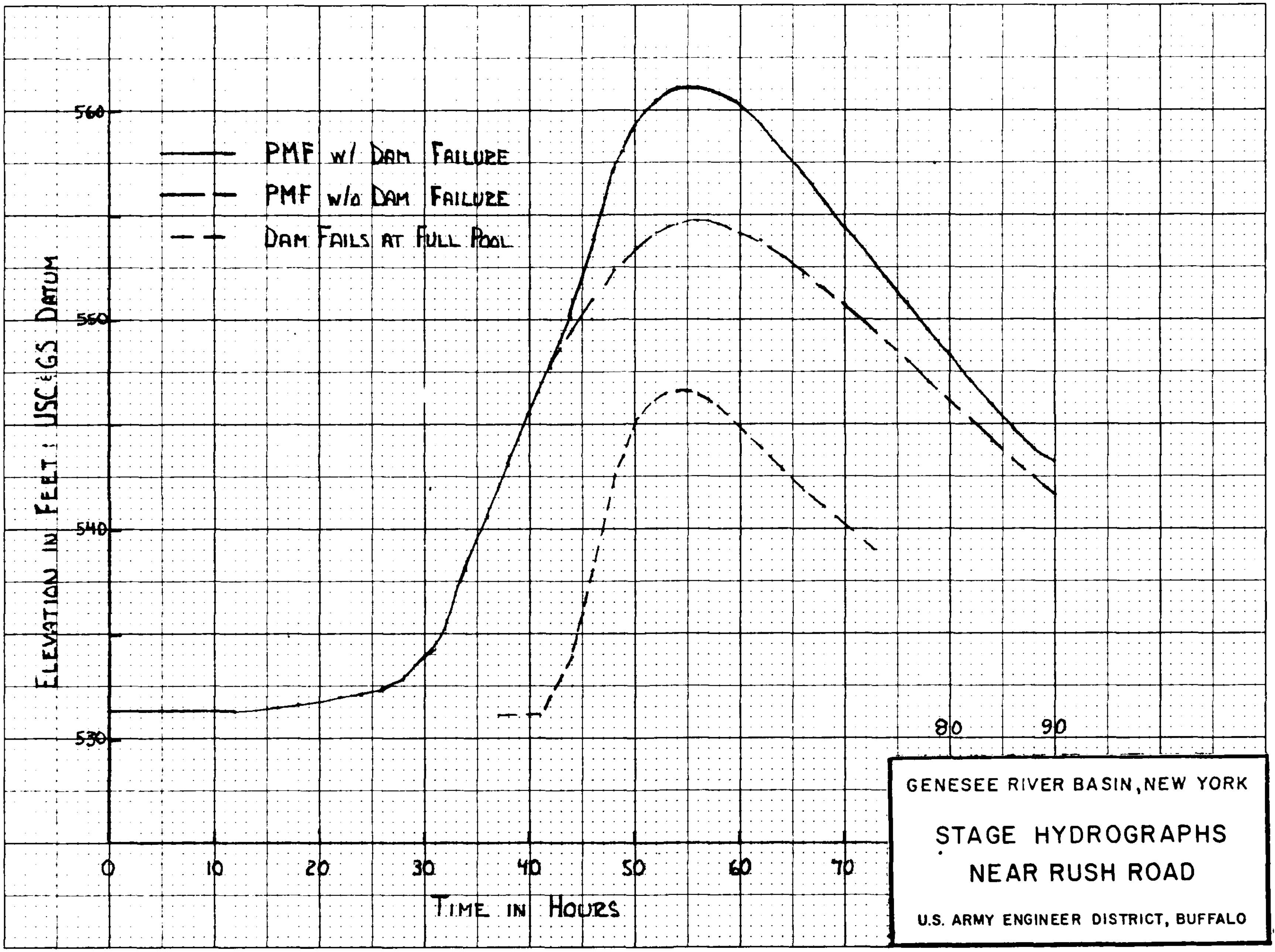


GENESEE RIVER BASIN, NEW YORK

STAGE HYDROGRAPHS AT AVON GAGE

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A37

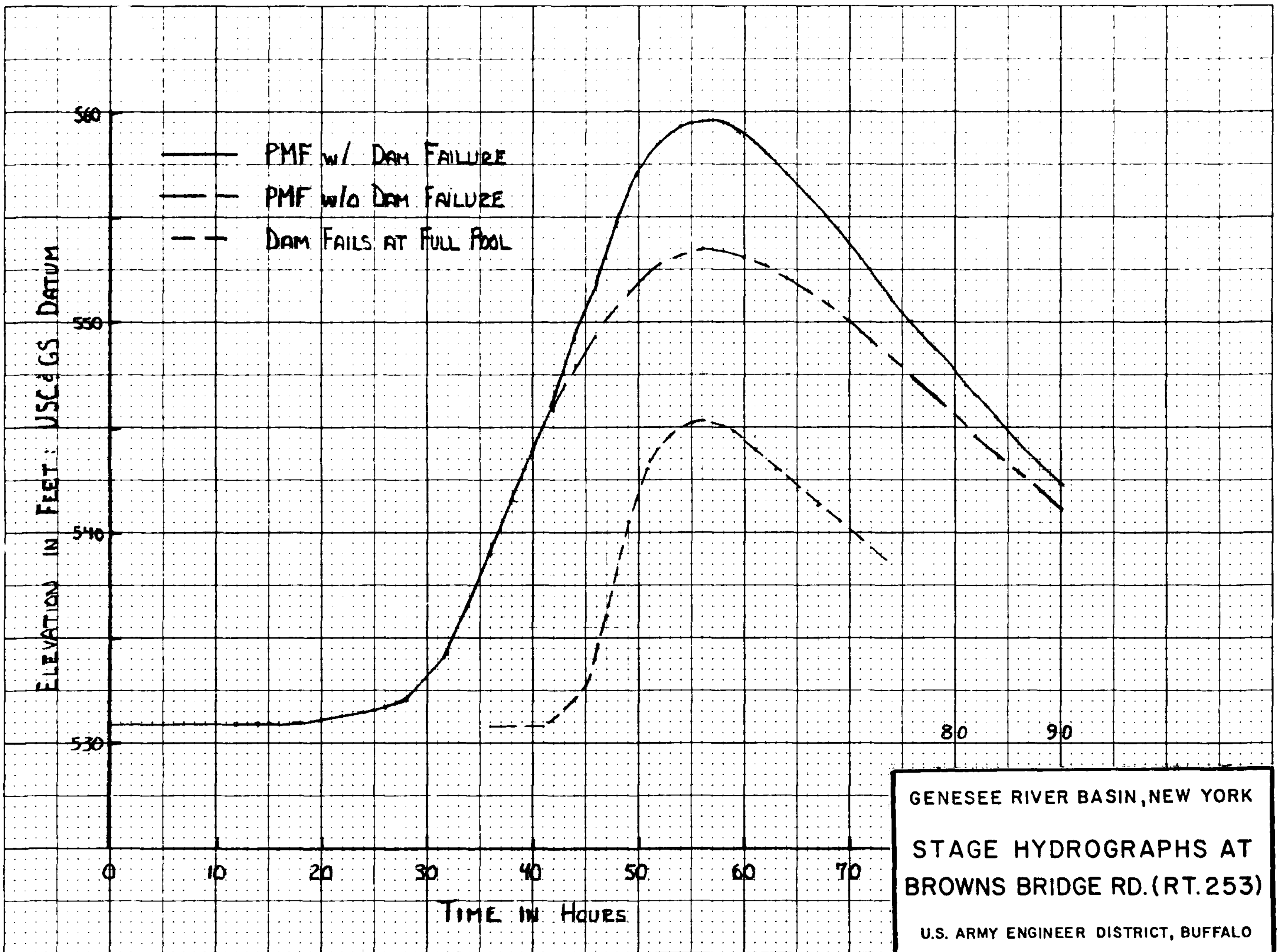


GENESEE RIVER BASIN, NEW YORK

STAGE HYDROGRAPHS
NEAR RUSH ROAD

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A38

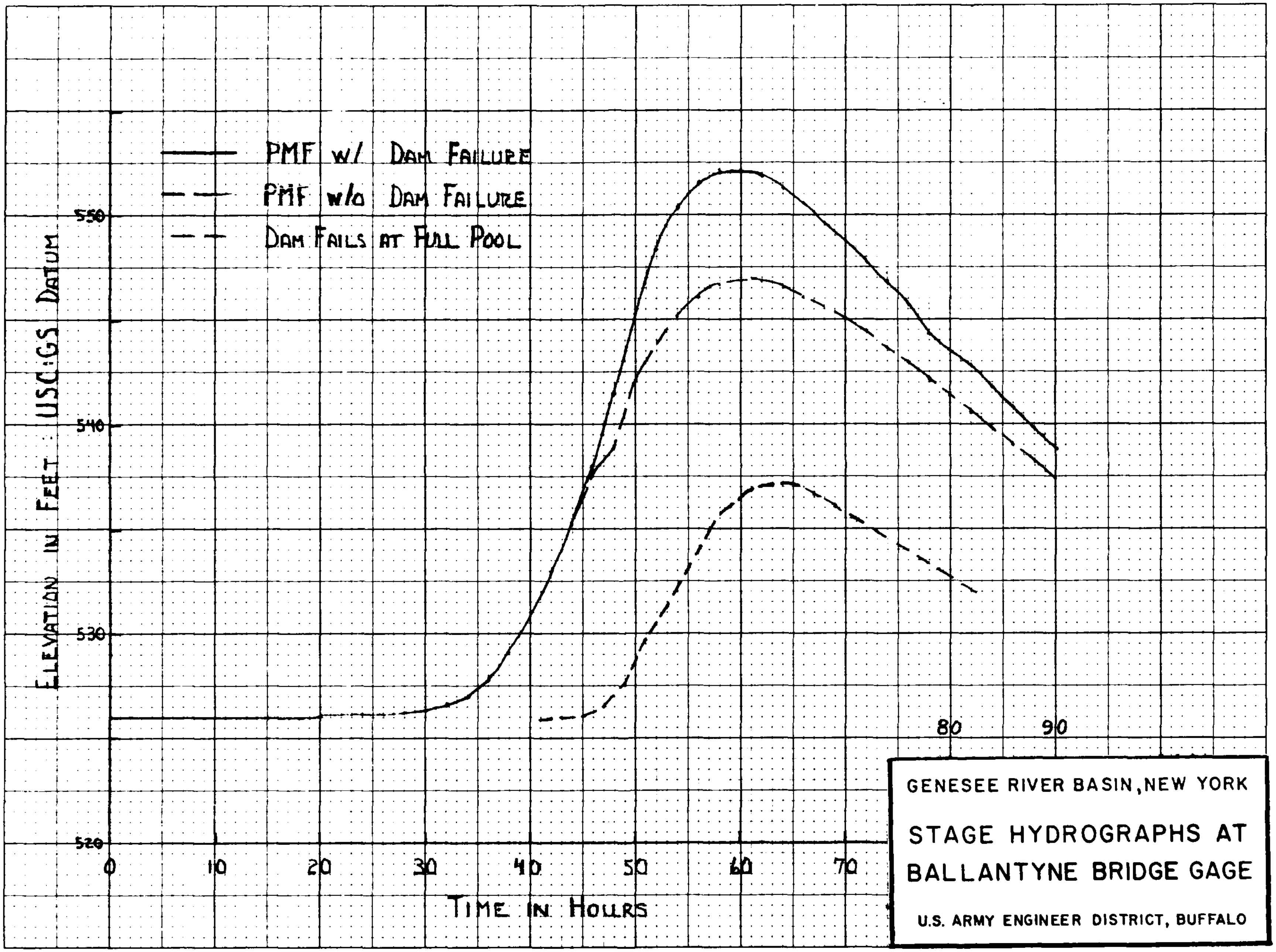


GENESEE RIVER BASIN, NEW YORK

STAGE HYDROGRAPHS AT BROWNS BRIDGE RD. (RT. 253)

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A39

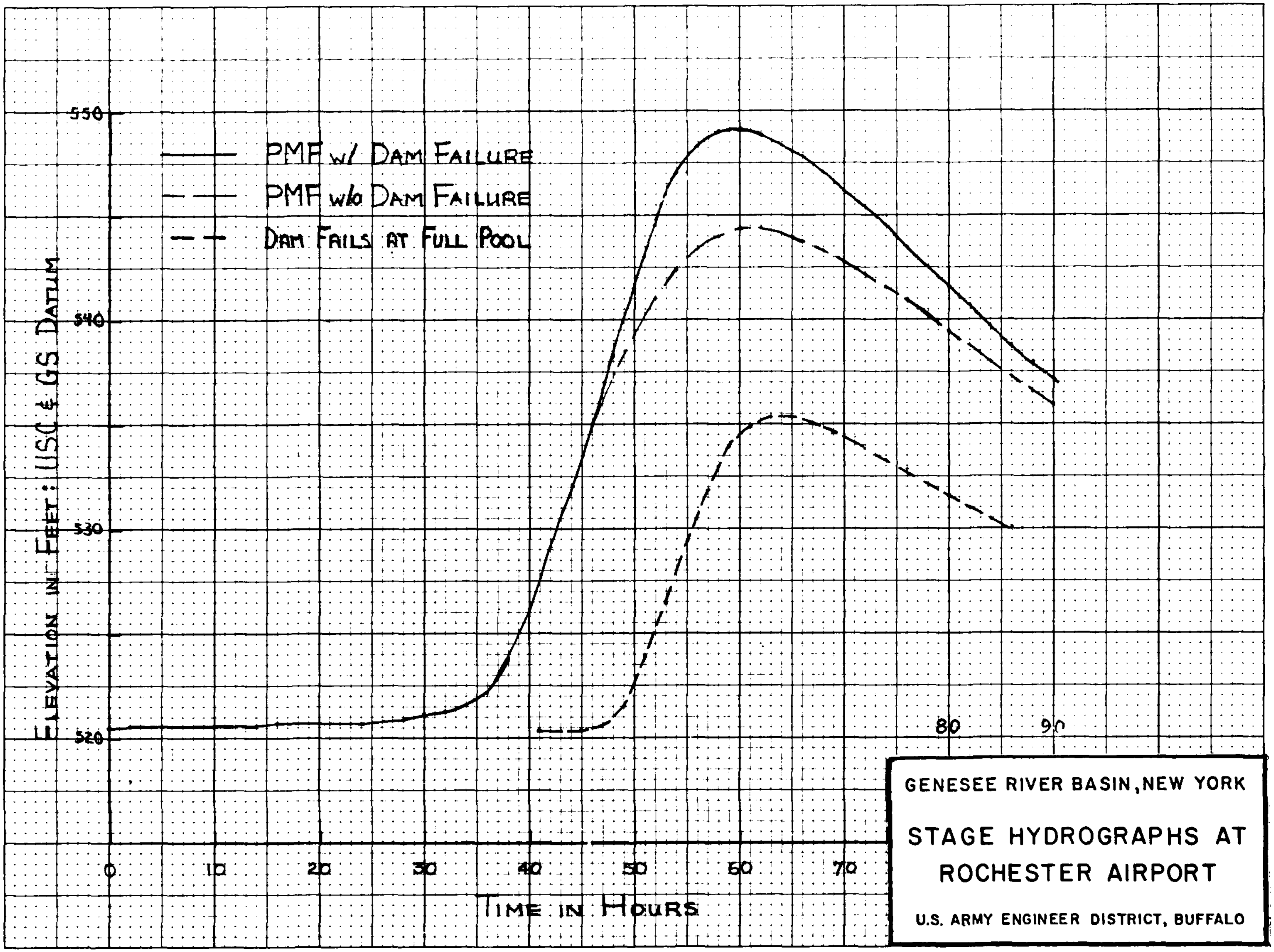


GENESEE RIVER BASIN, NEW YORK

STAGE HYDROGRAPHS AT BALLANTYNE BRIDGE GAGE

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A40

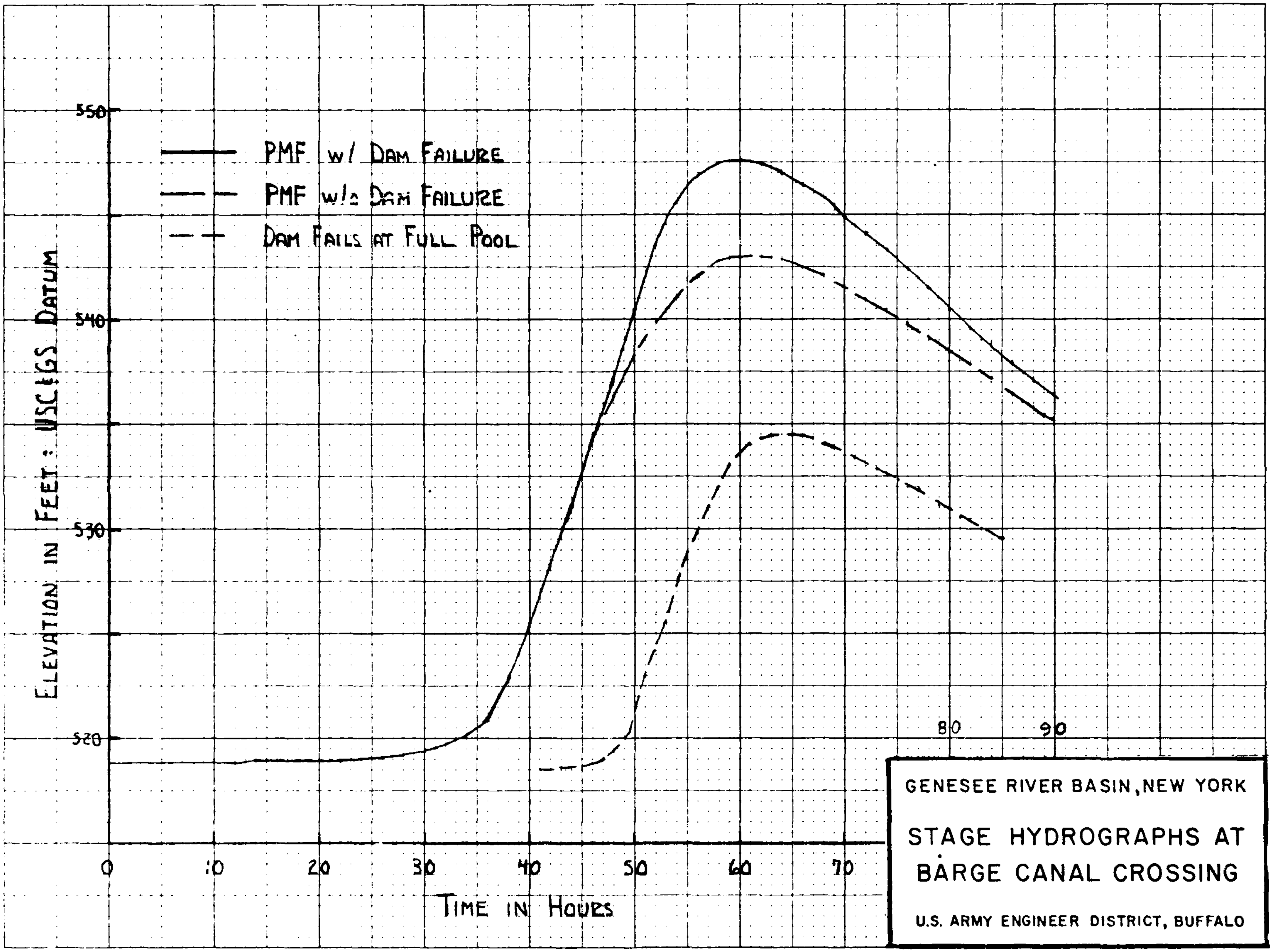


GENESEE RIVER BASIN, NEW YORK

STAGE HYDROGRAPHS AT ROCHESTER AIRPORT

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A41

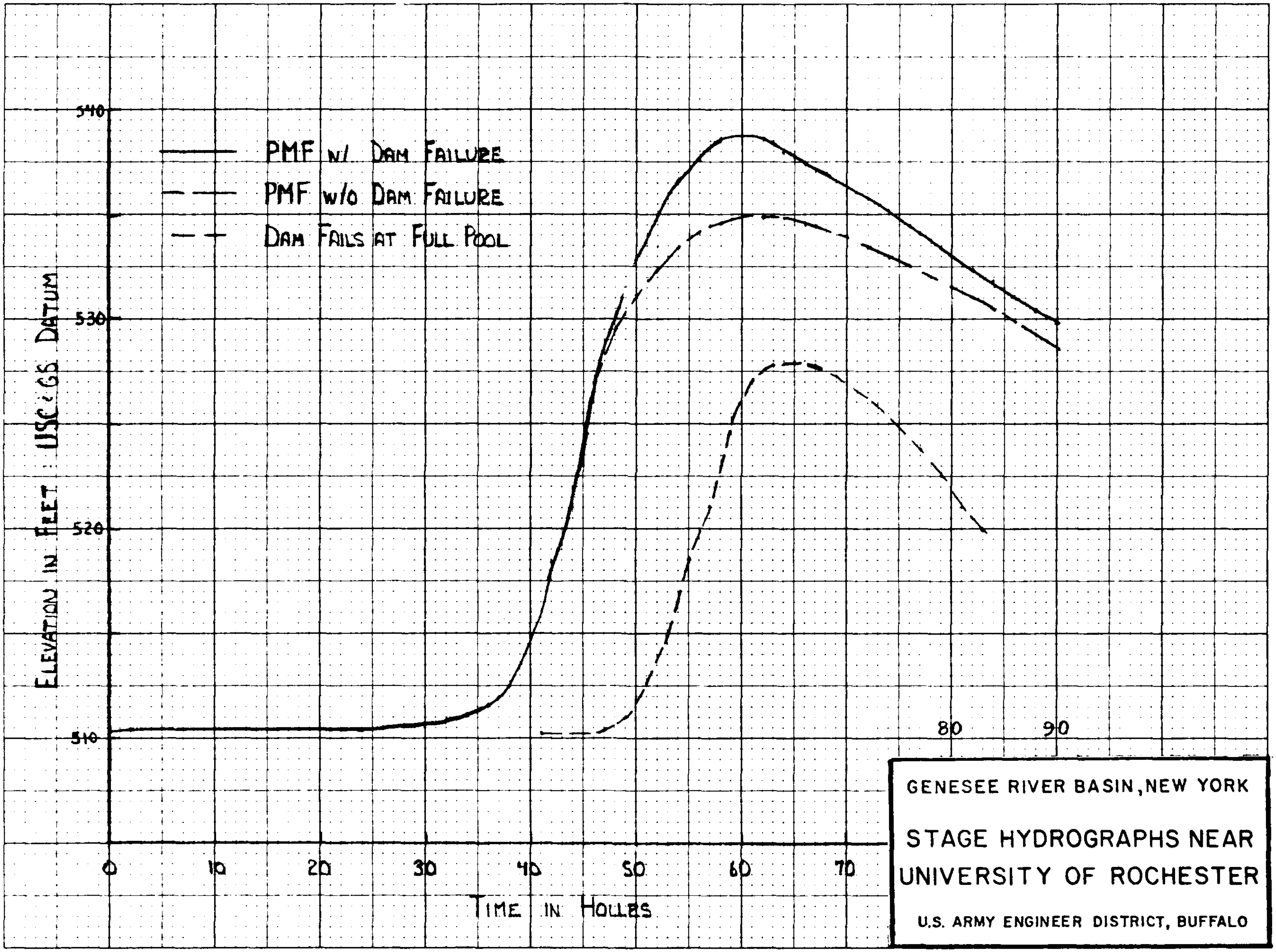


GENESEE RIVER BASIN, NEW YORK

STAGE HYDROGRAPHS AT BARGE CANAL CROSSING

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A42

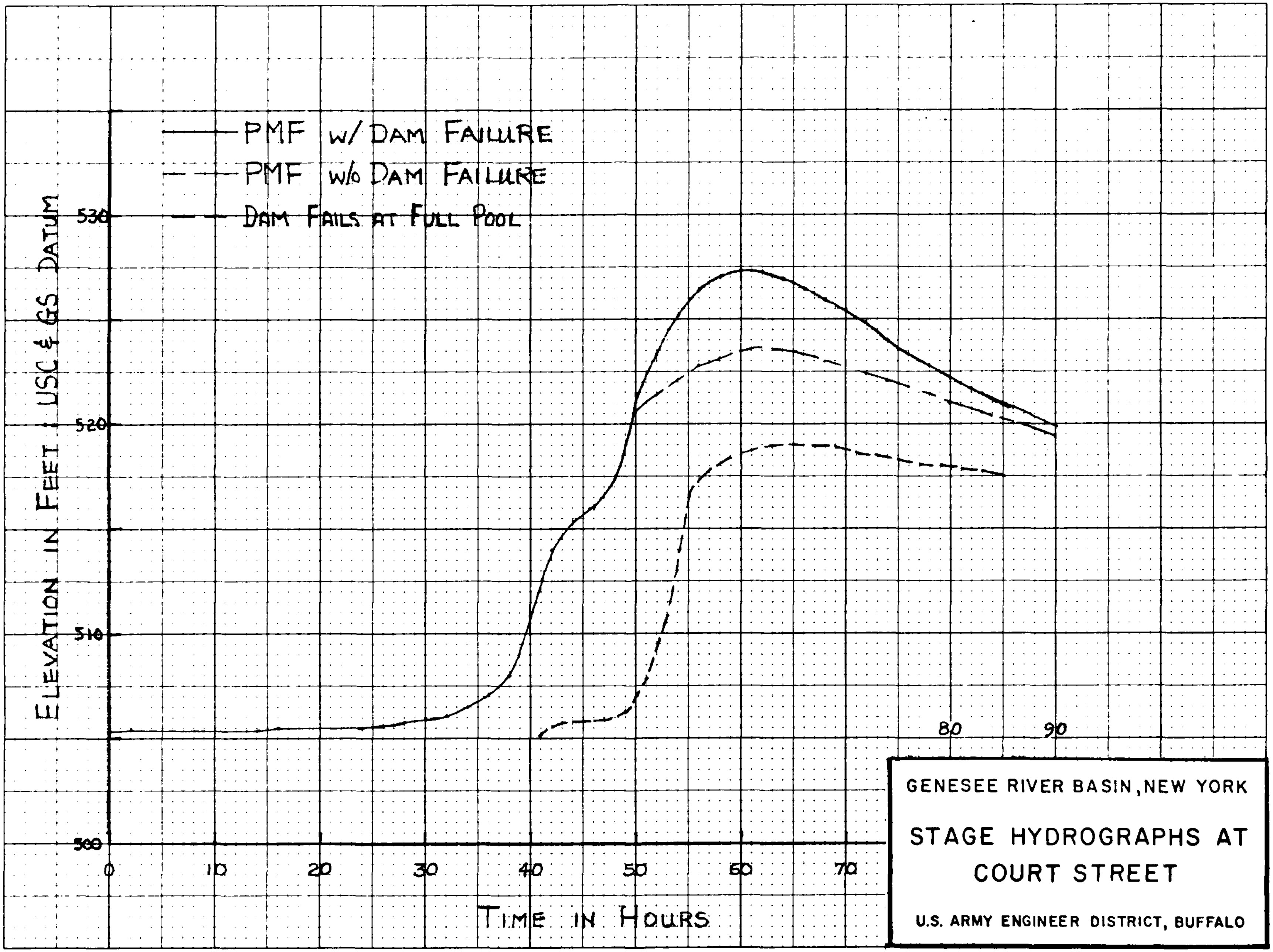


GENESEE RIVER BASIN, NEW YORK

STAGE HYDROGRAPHS NEAR UNIVERSITY OF ROCHESTER

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A43

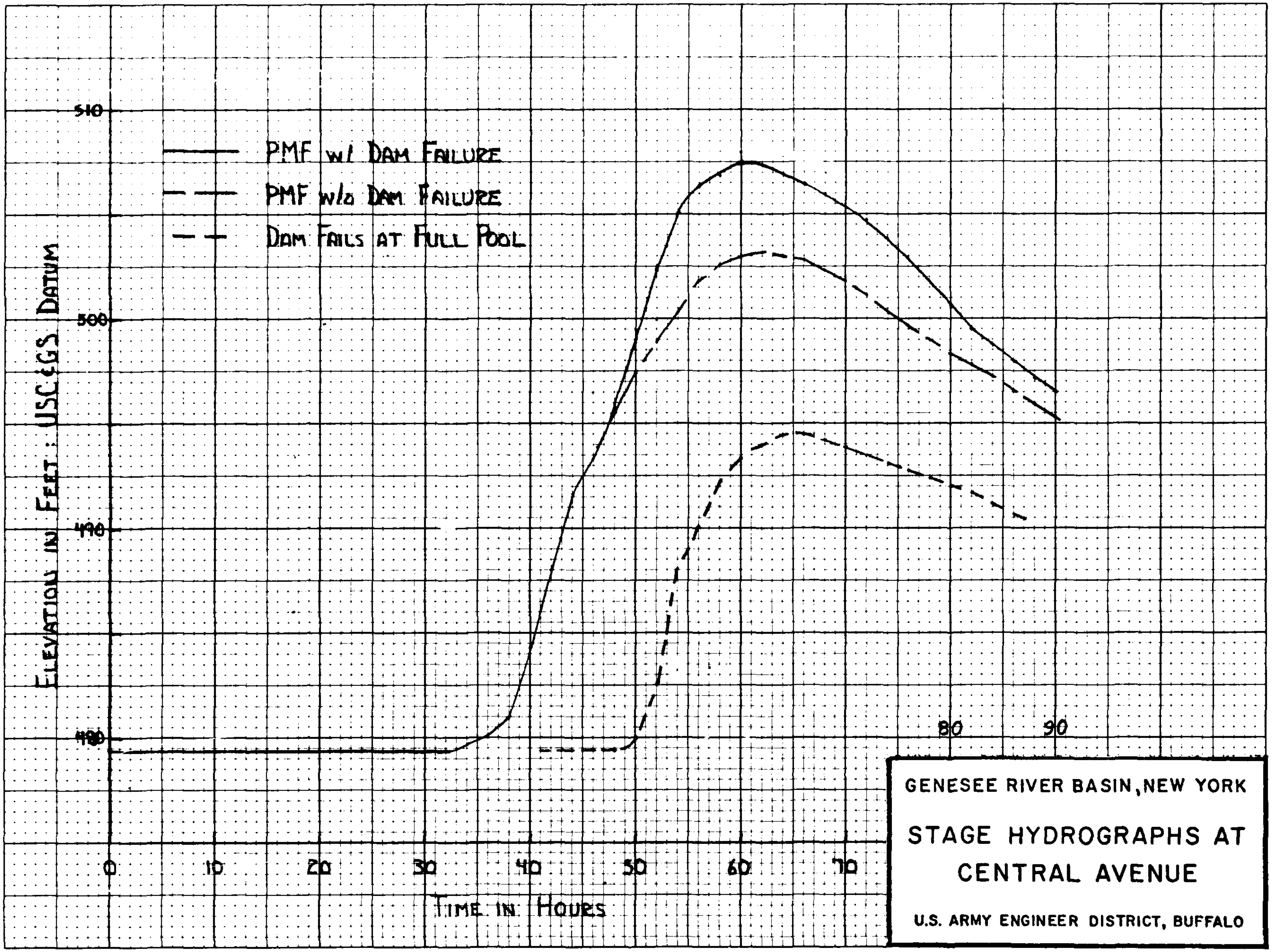


GENESEE RIVER BASIN, NEW YORK

STAGE HYDROGRAPHS AT COURT STREET

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A44

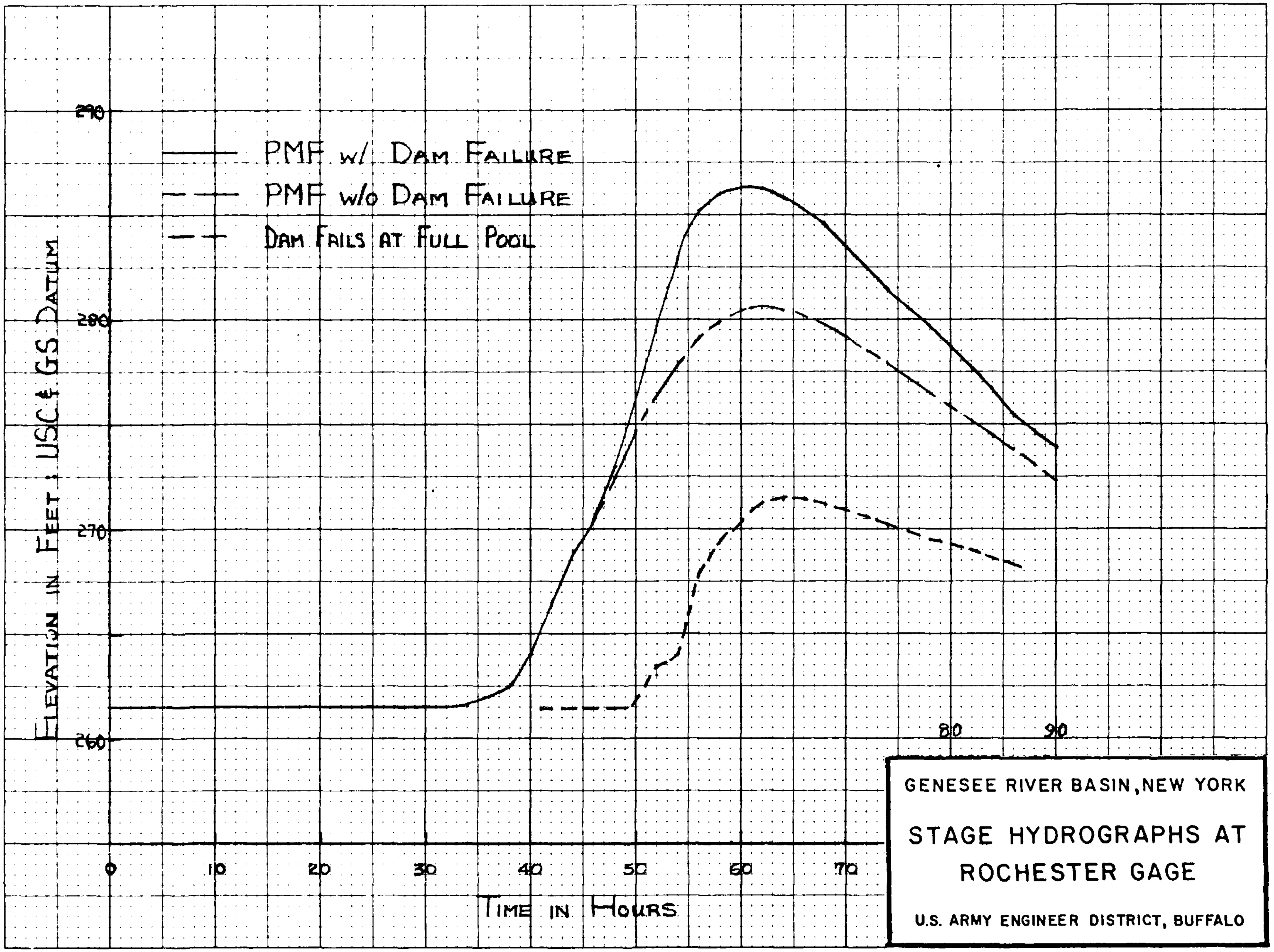


GENESEE RIVER BASIN, NEW YORK

STAGE HYDROGRAPHS AT CENTRAL AVENUE

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A45

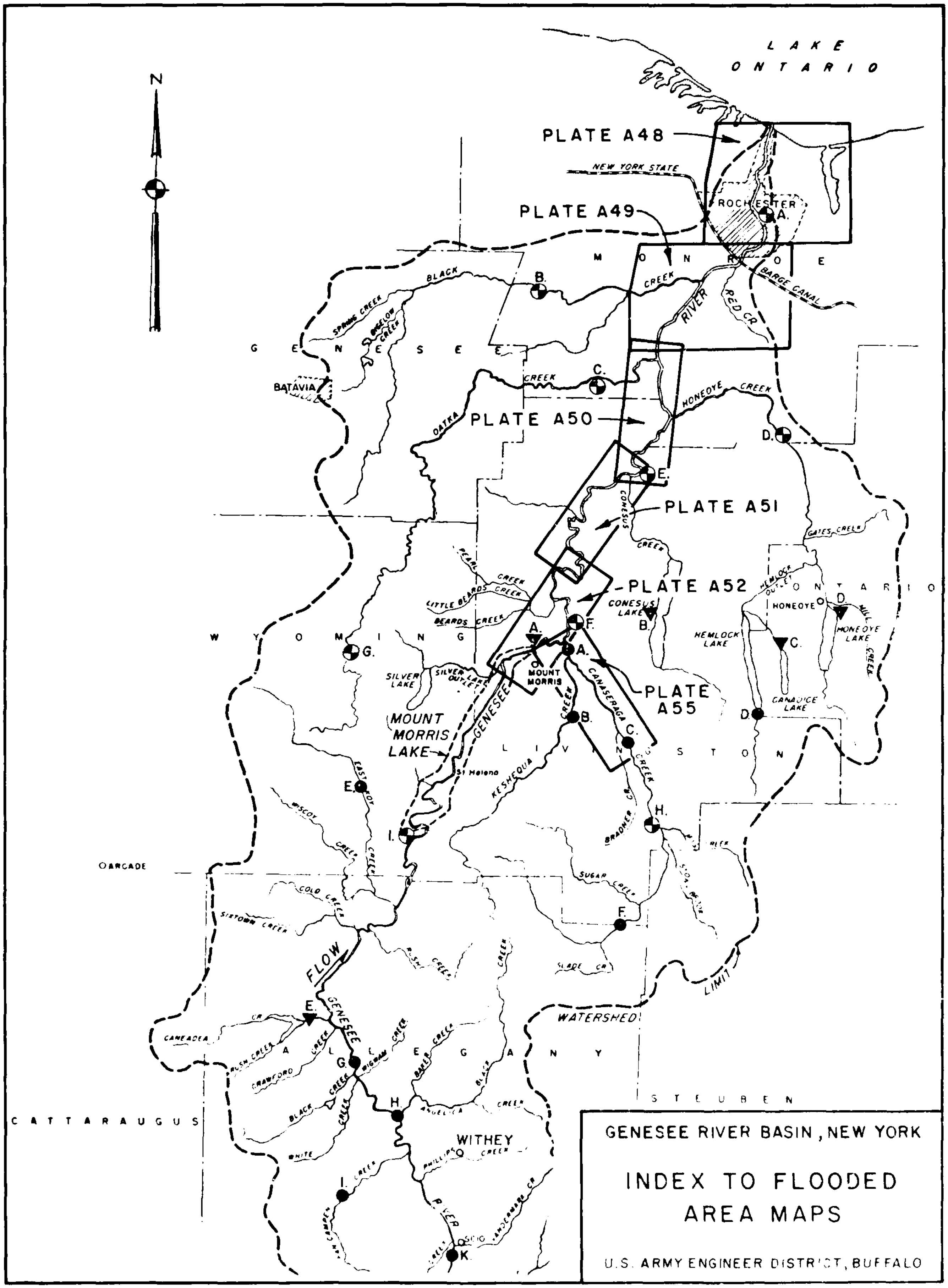


GENESEE RIVER BASIN, NEW YORK

STAGE HYDROGRAPHS AT ROCHESTER GAGE

U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A46



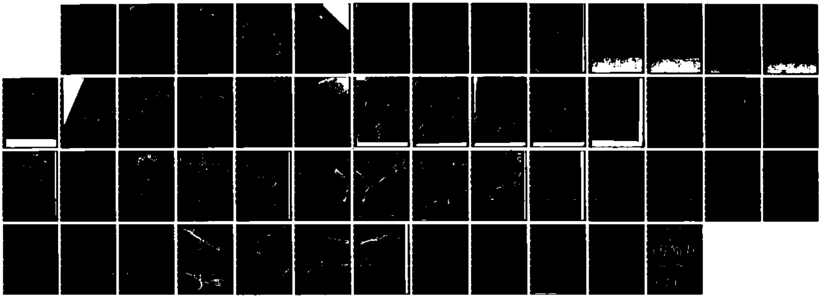
GENESEE RIVER BASIN, NEW YORK

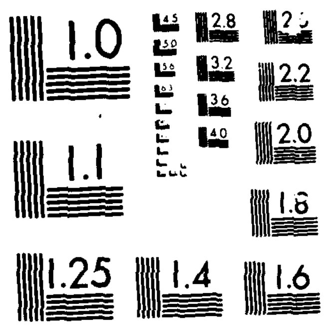
INDEX TO FLOODED AREA MAPS

U.S. ARMY ENGINEER DISTRICT, BUFFALO

AD-A165 438 FLOOD EMERGENCY PLAN FOR MOUNT MORRIS DAM GENESEE RIVER 2/2
WATERSHED NEW YORK VOLUME 2 APPENDIX A(U) CORPS OF
ENGINEERS BUFFALO NY BUFFALO DISTRICT OCT 85

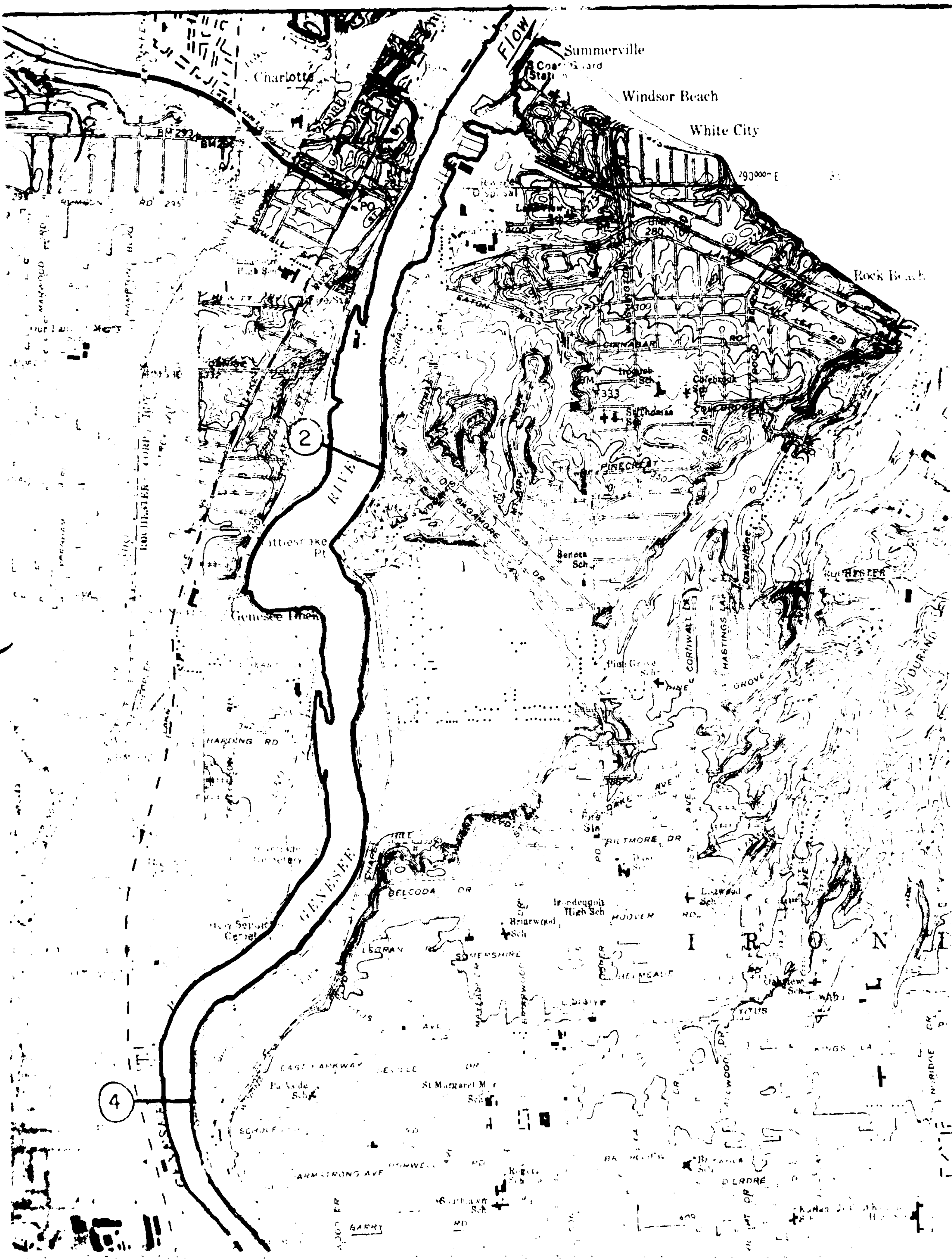
UNCLASSIFIED F/G 13/2 NL





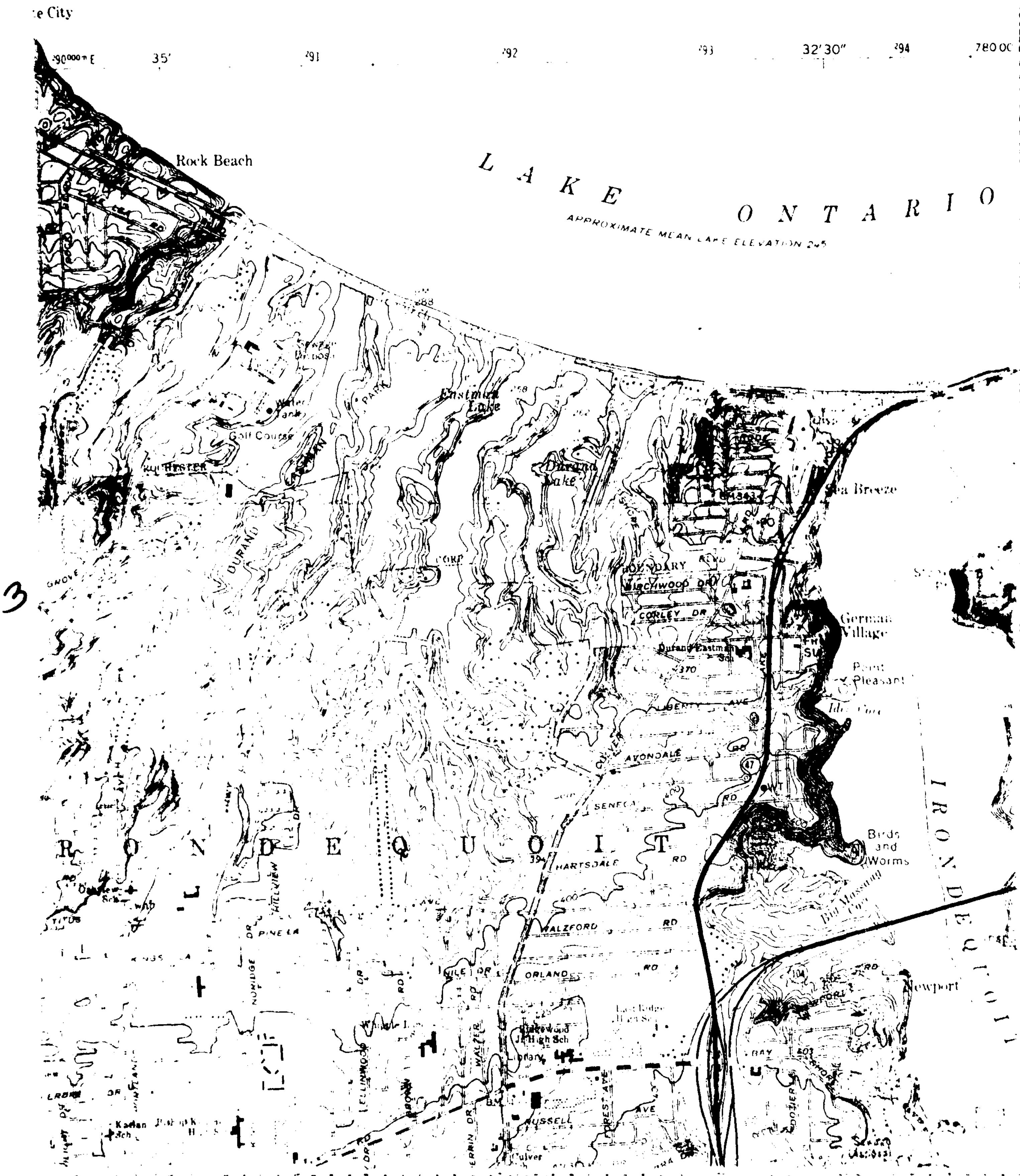
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963 A

Mount Read
Kirk
Creek
KAYMAR DR
MEADOWBRIAR RD
PICTURESQUE DRIVE
RUMSON RD
BM 293
295
DELLWOOD RD
MARWOOD RD
HAMPTON BLVD
Our Lady of Mercy Sch
DENISE ROAD
English Village Sch
Northgate Shopping Center
Britton Road Jr High Sch
PO
BRITTON
Fleming
STONEWOOD AVE
ALMAY
CONRAD
OHIO
ROCHESTER
Sch No 4
Parkland Sch
DORSEY RD
DRIVE
Fire Sta
St Charles Borromeo Sch
Barnard Sch
HAVILAND
WILLIS
FLORENCE AVE
E
Barnard
BALTIMORE
Uptonville
4



Flow
Summerville
Coast Guard Station
Charlotte
Windsor Beach
White City
Rock Beach
EATON RD
CINNABAR RD
PINECREST
SAGAMORE DR
2
RIVER
Rattlesnake Pt
Seneca Sch
Genesee Dock
CORNWALL LA
HASTINGS LA
Pine Grove Sch
PINE GROVE
HARDING RD
BILTMORE DR
GENESEE
BELCODA DR
Irondequoit High Sch
Briarwood Sch
HOOVER RD
I R O N
TITUS AVE
EAST PARKWAY
Parkside Sch
St Margaret Mary Sch
4
ARMSTRONG AVE

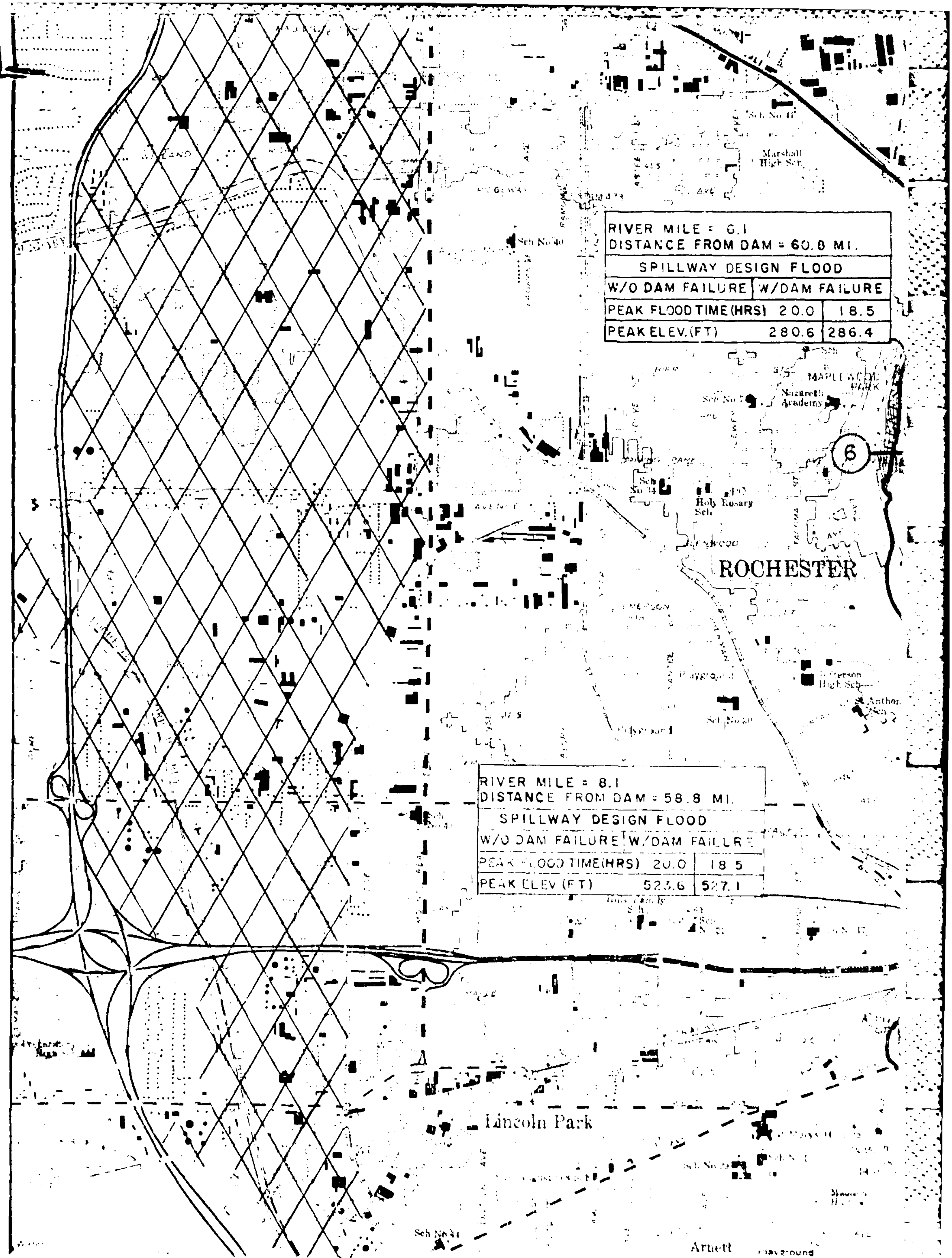
2



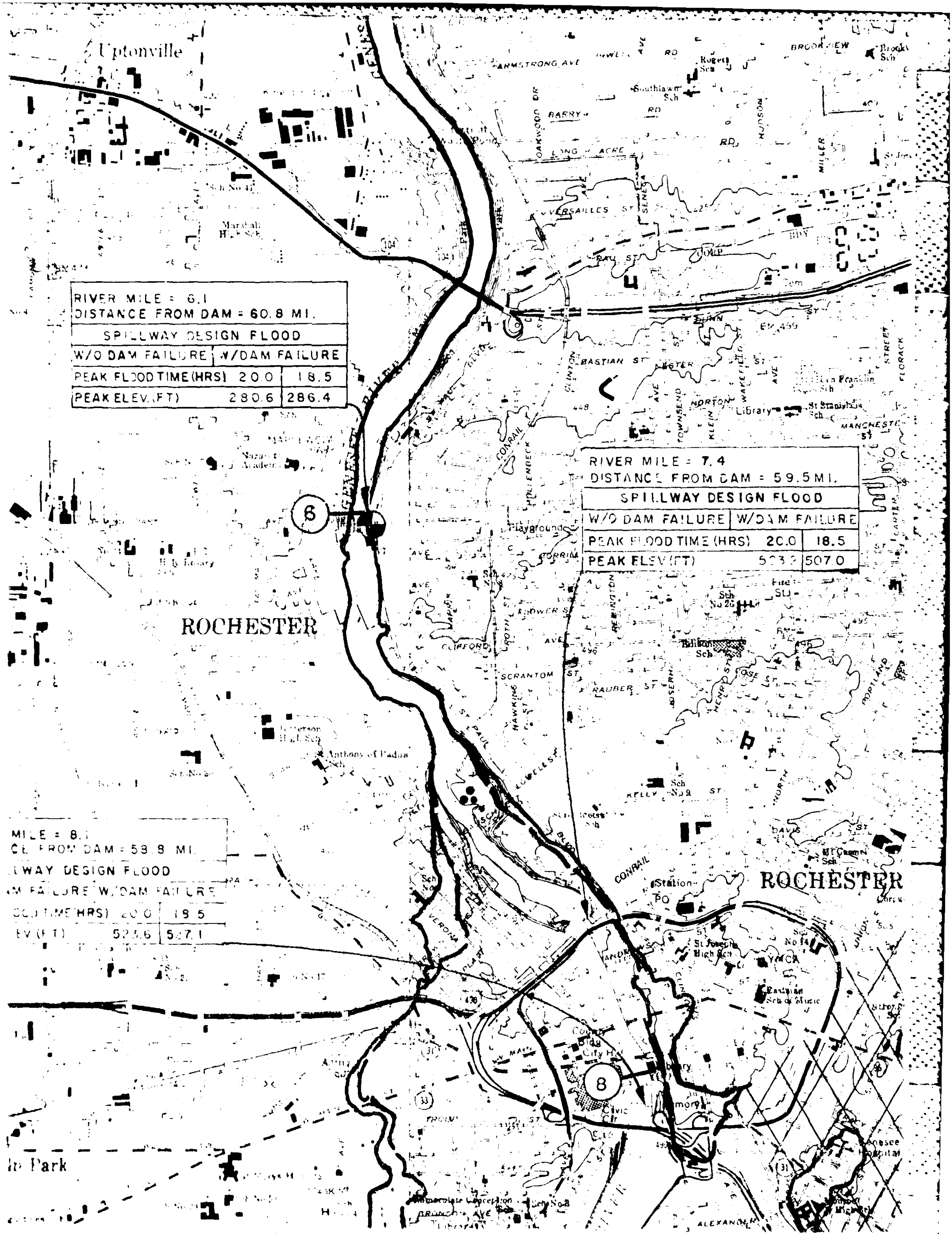
e City
290000m E
35'
291
292
293
32'30"
294
780 00
Rock Beach
L A K E O N T A R I O
APPROXIMATE MEAN LAKE ELEVATION 245
Water Tank
Golf Course
Eastman Lake
Durand Lake
Sea Breeze
BOUNDARY BLVD
BIRCHWOOD DR
CORLEY DR
Durand Eastman Sch
German Village
Point Pleasant
AVONDALE
SENECA
HARTSDALE RD
Birds and Worms
I R O N D E Q U O I T
WALZFORD RD
ORLAND
Newport
RUSSELL
Culver
3

296
Forest Lawn
Oklahoma Beach
VOSBURG
HOLLYWOOD
BLVD
APPLE ORCHARD LA
BACKUS
BIRCH LA
Bay Road Sch
WELLINGTON RD
4
W E B S T E R
LONGVIEW DR
OAKWOOD LA
OAKDALE DR
VOLK RD
COLORADO DR
BAYSIDE DR
104
Glen Edith
N

5

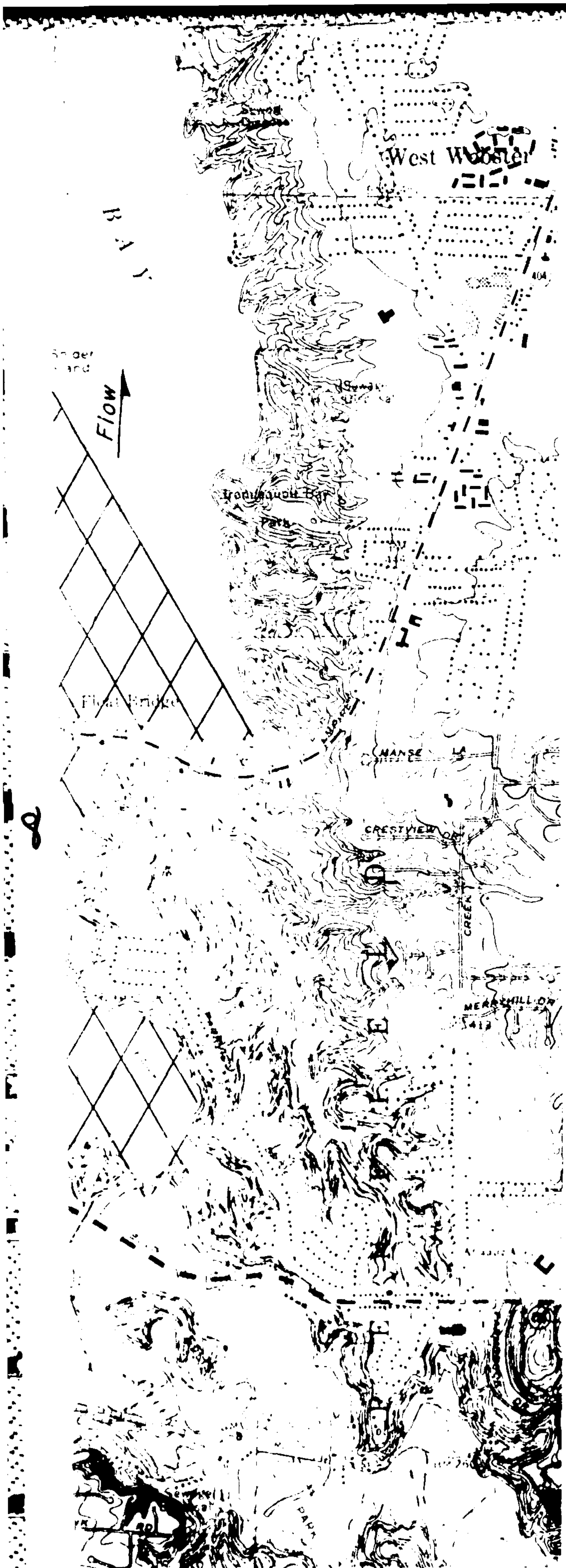


RIVER MILE = 6.1
DISTANCE FROM DAM = 60.8 MI.
SPILLWAY DESIGN FLOOD
W/O DAM FAILURE
W/DAM FAILURE
PEAK FLOOD TIME (HRS) 20.0 18.5
PEAK ELEV. (FT) 280.6 286.4
RIVER MILE = 8.1
DISTANCE FROM DAM = 58.8 MI.
SPILLWAY DESIGN FLOOD
W/O DAM FAILURE
W/DAM FAILURE
PEAK FLOOD TIME (HRS) 20.0 18.5
PEAK ELEV (FT) 523.6 527.1
ROCHESTER
Lincoln Park
Marshall High Sch
Sch No 40
Nazareth Academy
MAPLEWOOD PARK
Holy Rosary Sch
Sch No 34
6
Arnett
Playground


RIVER MILE = 6.1
DISTANCE FROM DAM = 60.8 MI.
SPILLWAY DESIGN FLOOD
W/O DAM FAILURE | W/DAM FAILURE
PEAK FLOOD TIME (HRS) 20.0 | 18.5
PEAK ELEV. (FT) 280.6 | 286.4
RIVER MILE = 7.4
DISTANCE FROM DAM = 59.5 MI.
SPILLWAY DESIGN FLOOD
W/O DAM FAILURE | W/DAM FAILURE
PEAK FLOOD TIME (HRS) 20.0 | 18.5
PEAK ELEV. (FT) | 507.0
MILE = 8.1
CE FROM DAM = 58.8 MI.
LWAY DESIGN FLOOD
M FAILURE W/DAM FAILURE
TIME (HRS) 20.0 | 18.5
EV. (FT) | 527.1
6
8
ROCHESTER
ROCHESTER
Uptonville
GENESEE RIVER
CONRAIL
Library
Playground
YMCA
Station
PO

6

Bay View
Glen Hav
Fleetwood Dr
Whitlock
Wahl
Baker Ave
Ashwood Dr
Marne
Seymour
Wyndham Rd
Queensboro Rd
St Philip Neri Sch
Westchester
Culver
Tarrington Rd
Farmington Rd
Pardee Sch
BM 397
Windemere
Blossom
Park Ave Hosp
Brighton



SCALE OF MILES

0 1/2 1

LEGEND:

U.S.G.S. RECORDING GAGE

I.P.2 INDEX POINT REACH 2

PROBABLE MAXIMUM FLOODED AREA WITH DAM FAILURE.

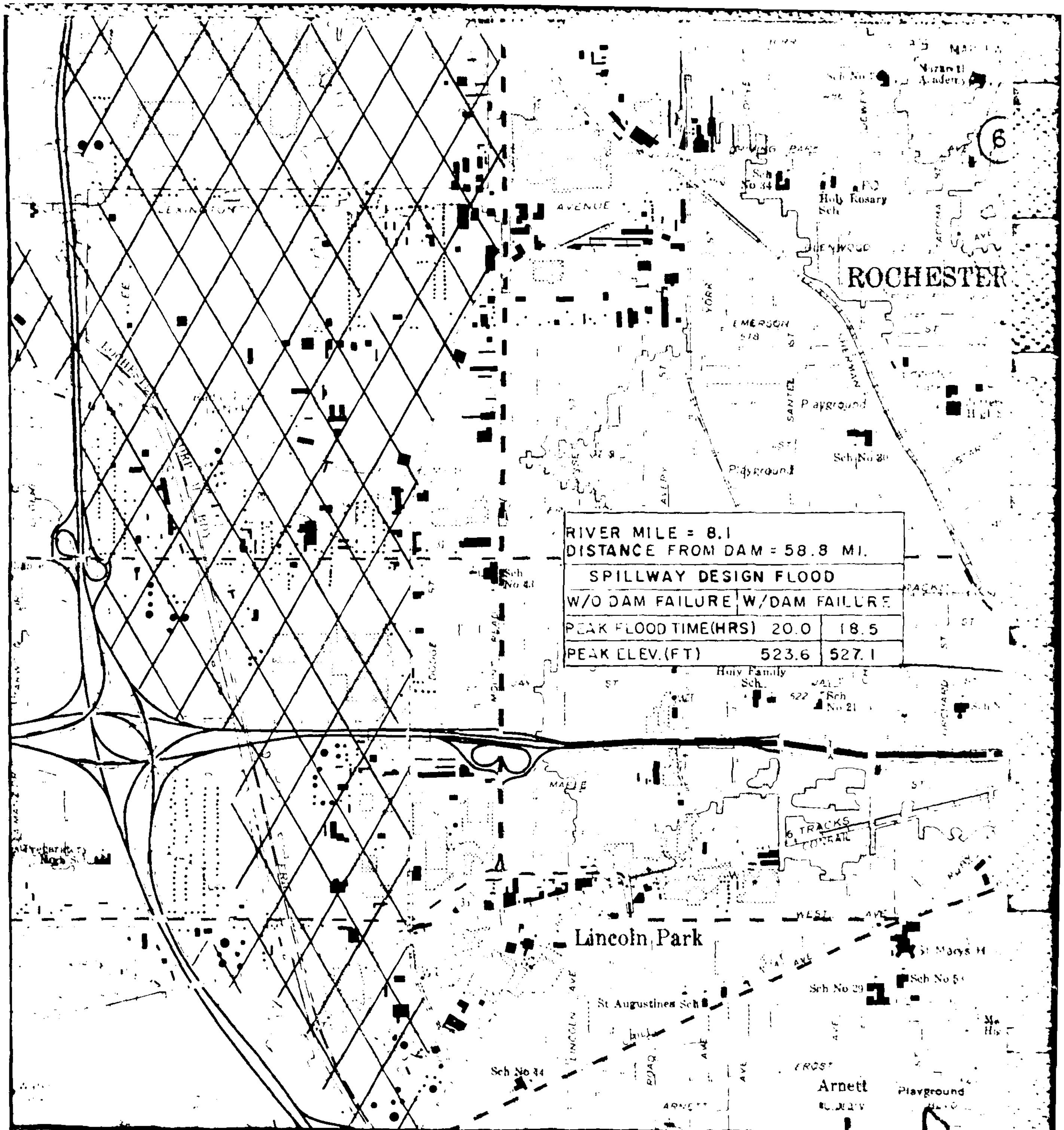
PROBABLE MAXIMUM FLOODED AREA WITHOUT DAM FAILURE.

APPROXIMATE OVERLAND FLOODING FOR PROBABLE MAXIMUM FLOOD WITH OR WITHOUT DAM FAILURE.

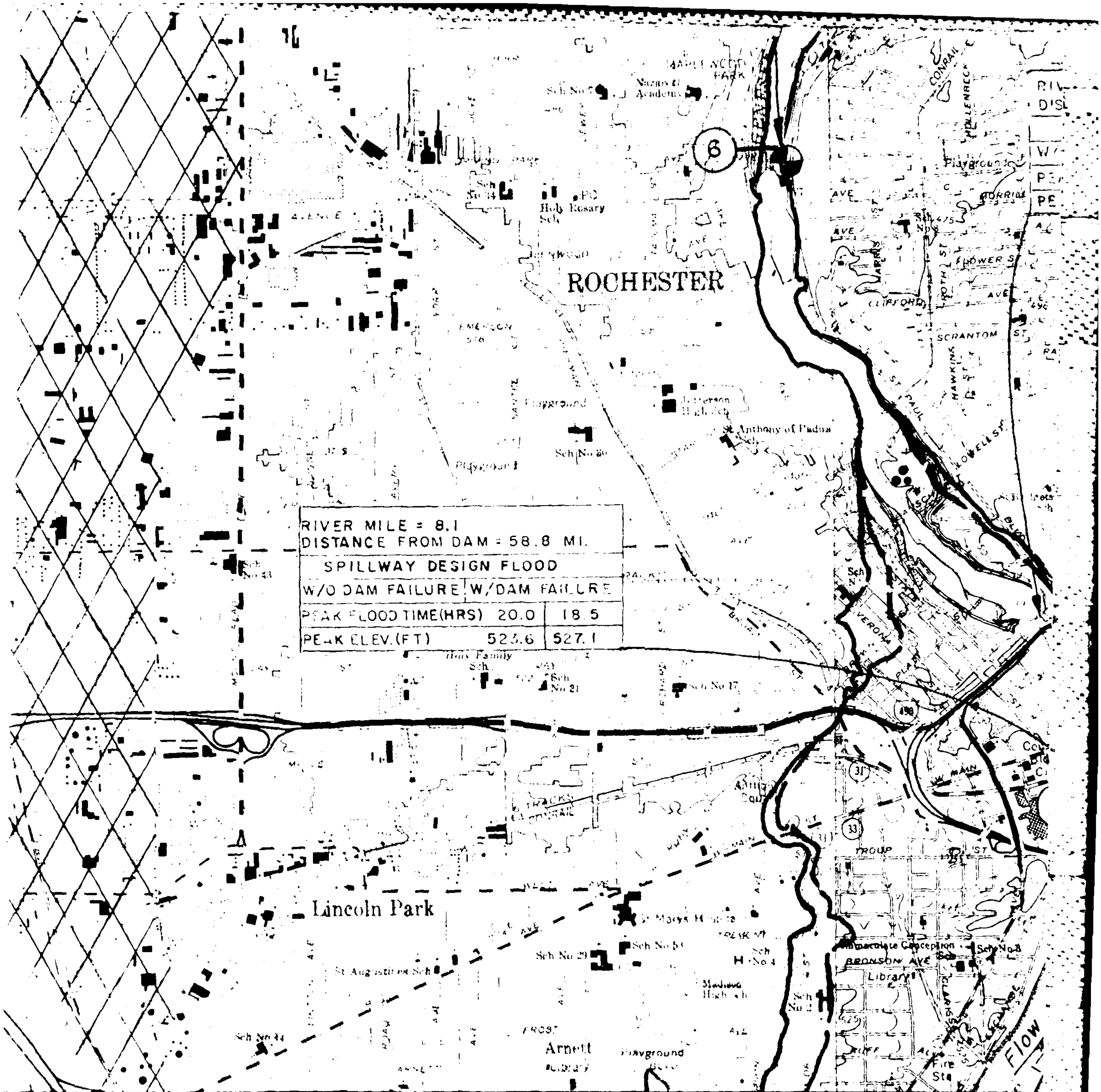
GENESEE RIVER BASIN, NEW YORK

ROCHESTER

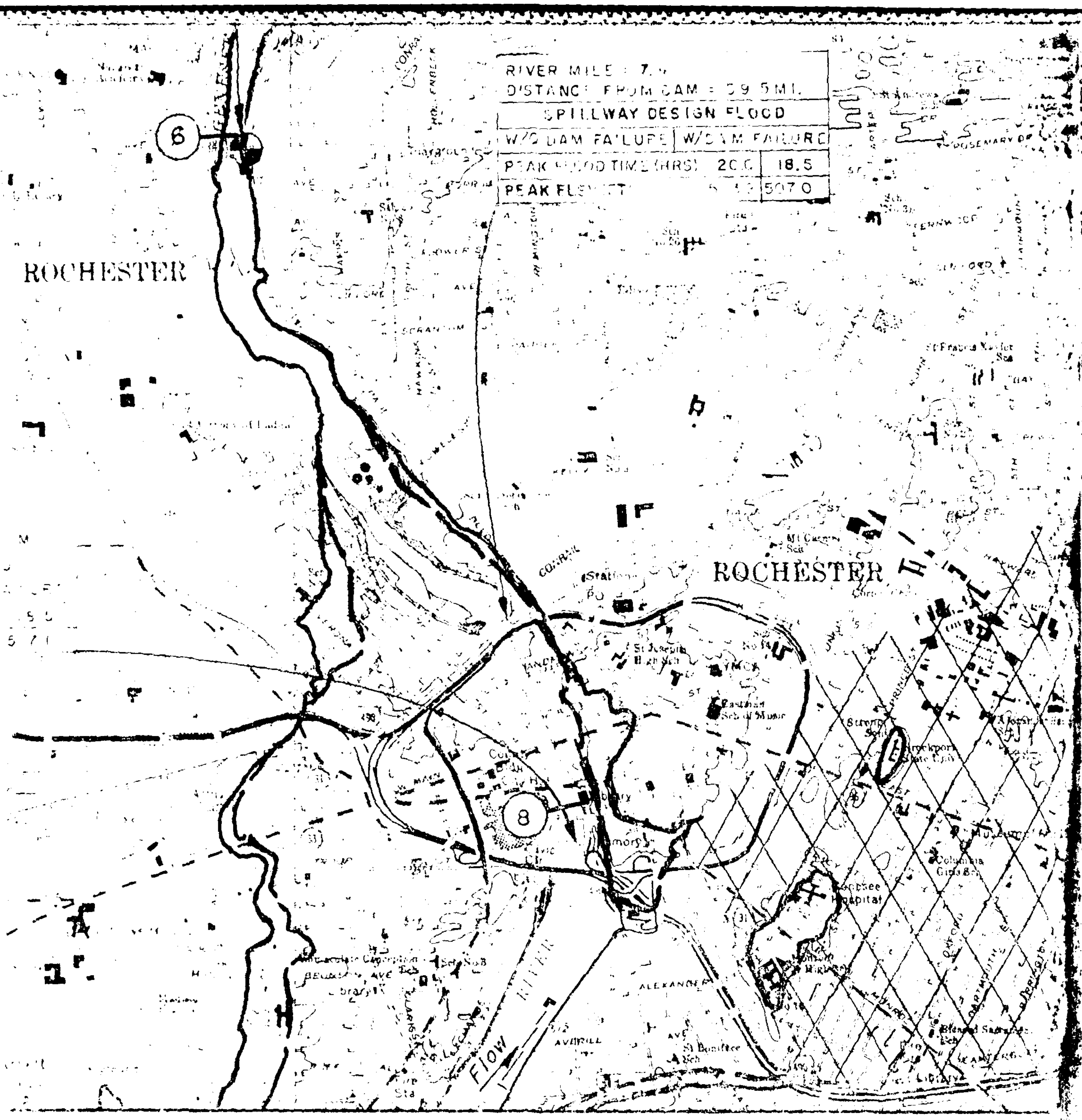
FLOODED AREAS


ROCHESTER
Lincoln Park
RIVER MILE = 8.1
DISTANCE FROM DAM = 58.8 MI.
SPILLWAY DESIGN FLOOD
W/O DAM FAILURE | W/DAM FAILURE
PEAK FLOOD TIME (HRS) 20.0 | 18.5
PEAK ELEV. (FT) 523.6 | 527.1
LEXINGTON
AVENUE
Holy Rosary Sch
Holy Family Sch.
St Augustines Sch
Sch No 84
Sch No 29
Sch No 80
Playground
Arnett
WEST AVE
6 TRACKS CONRAIL
St Marys H
YORK
EMERSON
MAPLE
LINCOLN AVE
FROST
6

9


ROCHESTER
Lincoln Park
RIVER MILE = 8.1
DISTANCE FROM DAM = 58.8 MI.
SPILLWAY DESIGN FLOOD
W/O DAM FAILURE
W/DAM FAILURE
PEAK FLOOD TIME (HRS) 20.0 18.5
PEAK ELEV. (FT) 523.6 527.1
6
Holy Rosary Sch
St Anthony of Padua
Playground
St Marys Hospital
St Augustine Sch
Immaculate Conception
Library
Arnett
Playground
TROUP
BRONSON AVE
SCRANTOM ST
CLIFFORD
FLOWER ST
LOWELL ST
VERONA
W MAIN
FROST
FLOW

10



RIVER MILE
DISTANCE FROM DAM
SPILLWAY DESIGN FLOOD
W/O DAM FAILURE
W/DAM FAILURE
PEAK FLOOD TIME (HRS)
20.0
18.5
PEAK ELEV
507.0
ROCHESTER
ROCHESTER
6
8
FLOW
RIVER
ALEXANDER
AVERILL
St Boniface Sch
Eastman Sch of Music
YMCA
St Joseph High Sch
Genesee Hospital
Columbia Girls Sch
St Francis Xavier Sch
Mt Carmel Sch
SCRANTON
Station
CONRAIL

ESTER
Sch No 39
YATES
ASHWOOD DR
MARNE
NORTON
AVE
RANDOLPH
NORTHLAND
ROSEMARY DR
GOODMAN
SEYMOUR RD
Dewey Jr High Sch
St Philip Neri Sch
NEWCOMB
ABRUTUS
CLAIRMOUNT
ROCKET
BAYCLIFF DR
WESTCHESTER
CULVER
FALSTAFF
VERMONT TER
WOODROW AVE
HAZELWOOD
WEBSTER
GARSON
Sch No 10
DENVER
CEDARWOOD
MAIN
CHAMBERLAIN ST
BOWMAN ST
MERCHANTS
McKINLEY
QUEENSBORO RD
ELLEN DR
WYNDHAM
BM 397
PKWY
TARRINGTON
St James Sch
FARMINGTON RD
WINSTEAD RD
ELM
Library
WINDEMERE RD
Sch No 28
St Johns Sch
East High Sch
WOODSTOCK
CROYDON RD
FAIRHAVEN RD
Brighton
Museum of Arts & Sciences
Columbia Girls Sch
Genesee Hospital
Alexander Hamilton
ATLANTIC
Phoenix Sch
Rockester Academy of Medicine
Park Ave Hosp
Sch No 23
DARTMOUTH
HARVARD
Armory
CANTERBURY
Library
KINMAR
12

SCALE OF MILES

0 1/2 1

LEGEND:

U.S.G.S. RECORDING GAGE

I.P.2 INDEX POINT REACH 2

PROBABLE MAXIMUM FLOODED AREA WITH DAM FAILURE.

PROBABLE MAXIMUM FLOODED AREA WITHOUT DAM FAILURE.

APPROXIMATE OVERLAND FLOODING FOR PROBABLE MAXIMUM FLOOD WITH OR WITHOUT DAM FAILURE.

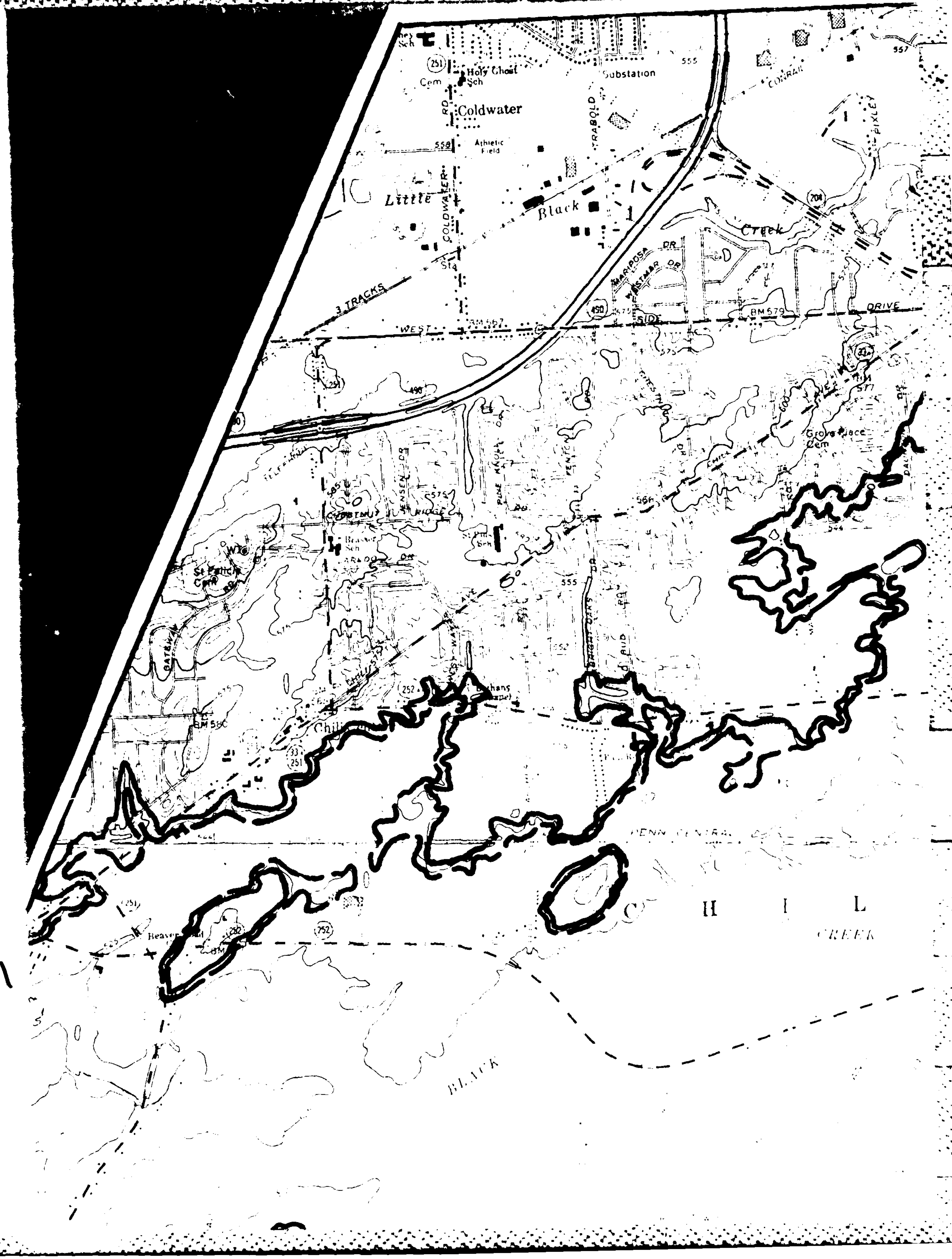
GENESEE RIVER BASIN, NEW YORK

ROCHESTER

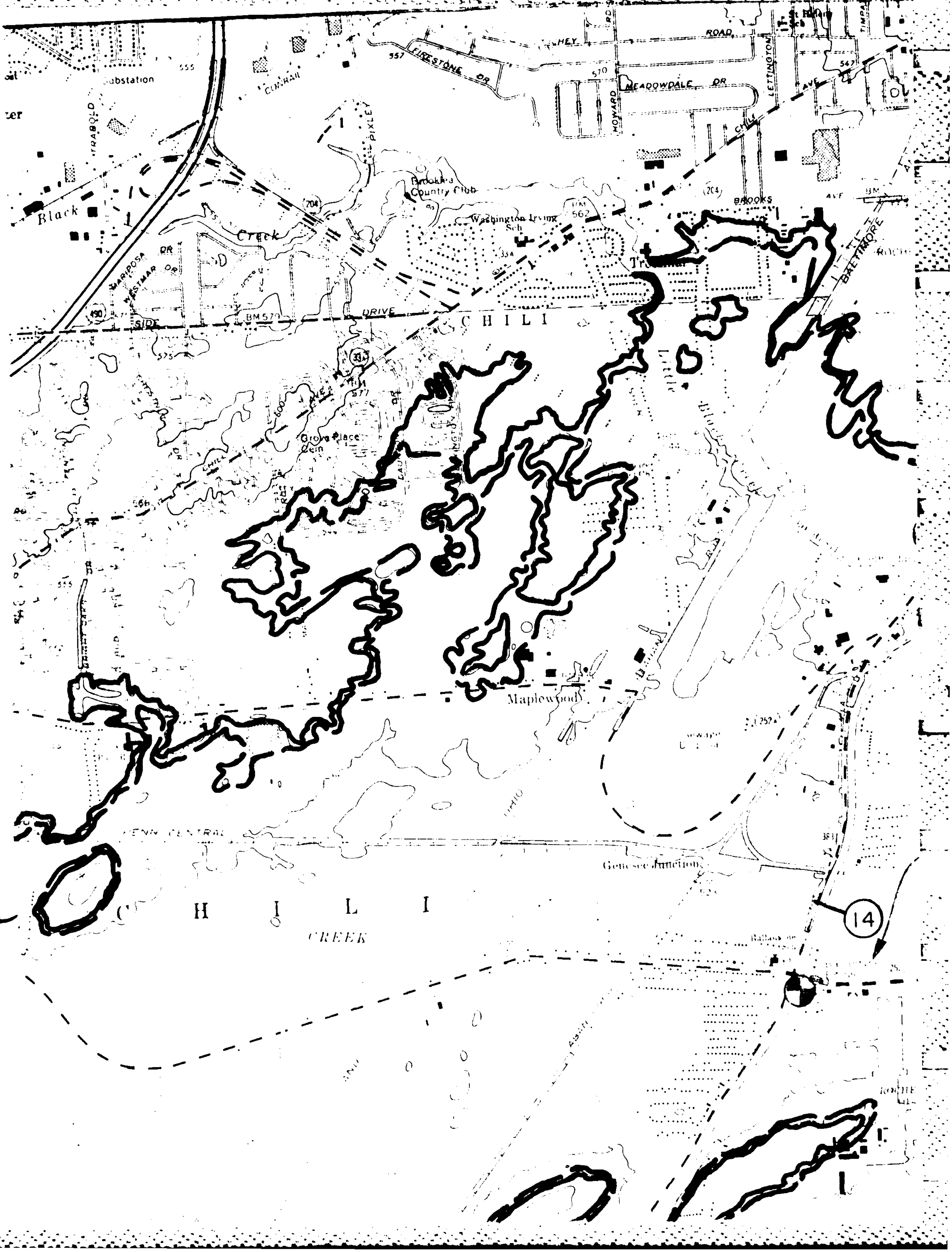
FLOODED AREAS

U.S. ARMY ENGINEER DISTRICT, BUFFALO

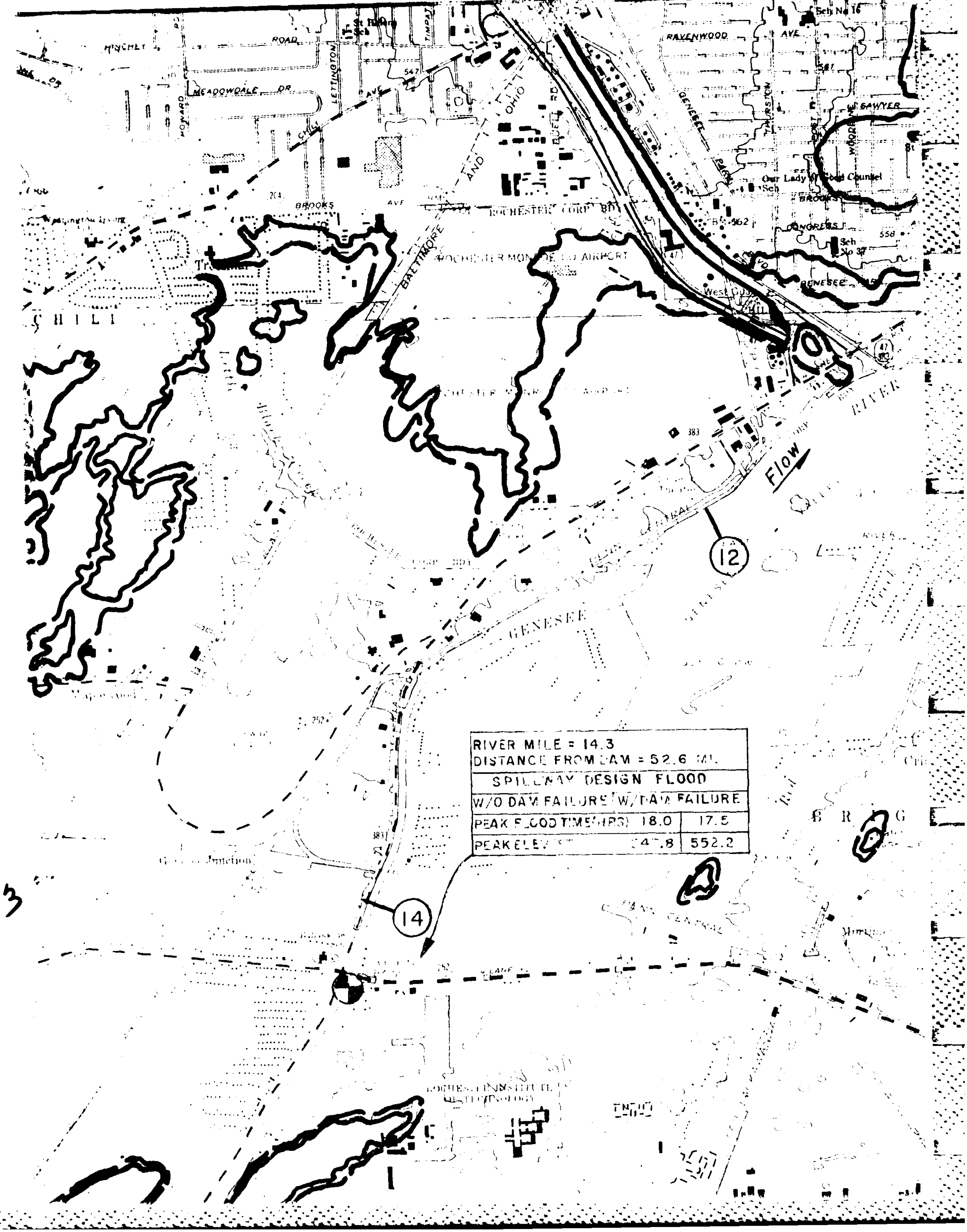
PLATE A48



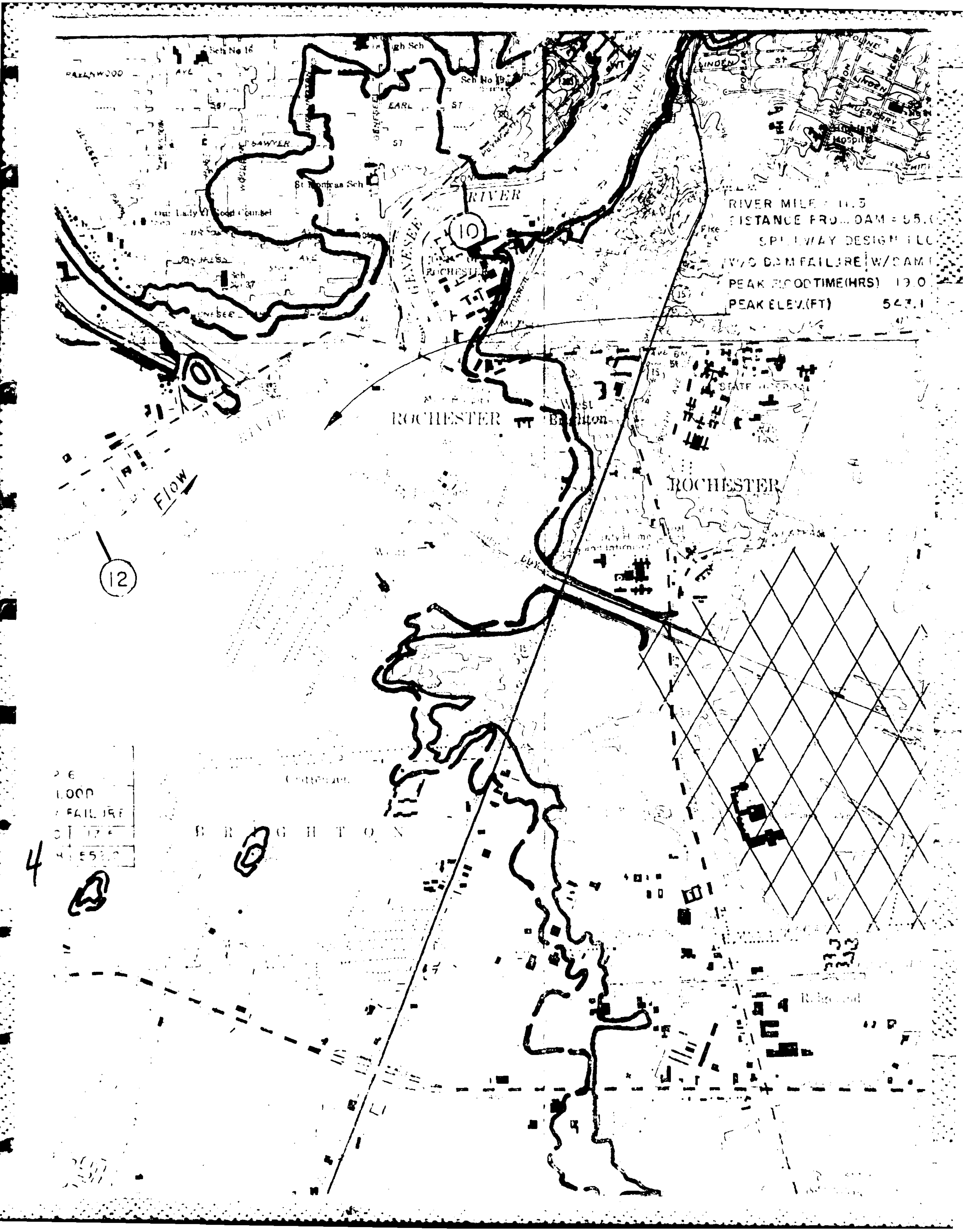
Holy Ghost Sch
Cem
Coldwater
Substation
Athletic Field
Little Black Creek
COLDWATER RD
TRABOLD
CONRAIL
PIXLEY
MARIPOSA DR
WESTMAR DR
3 TRACKS
WEST SIDE DRIVE
BM 567
BM 579
Grove Place Cem
JENSEN DR
PINE KNOLL DR
RIDGE
Beaver Sch
St Pius Sch
St Patricks Cem
BM 560
Chili
BRIGHT OAKS DR
BM
PENN CENTRAL
C H I L
CREEK
BLACK
Beaver Road



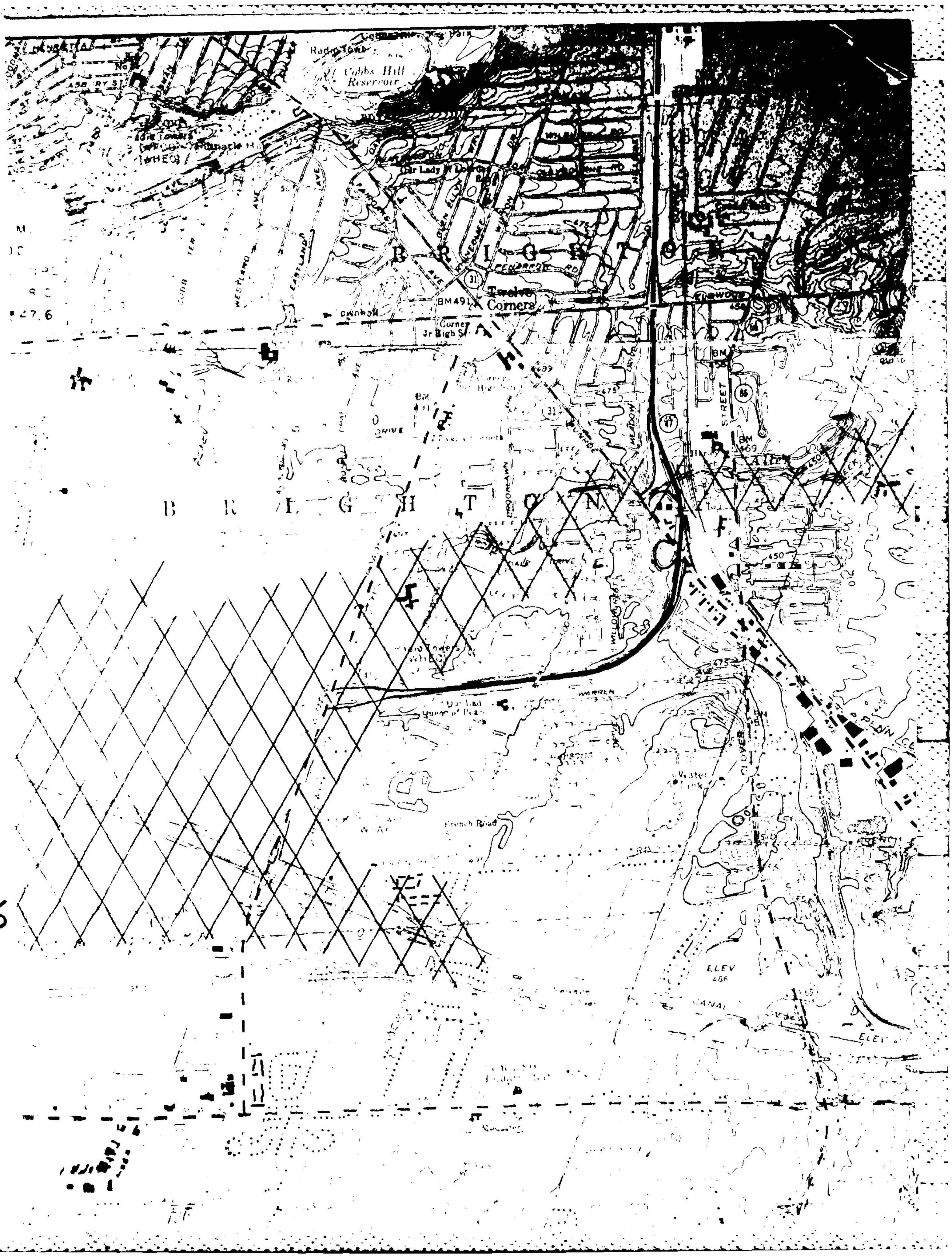
Substation
Black
Creek
Brooklea Country Club
Washington Irving Sch
BROOKS AVE
CHILI
Grove Place Cem
Maplewood
PENN CENTRAL
Genesee Junction
C H I L I
CREEK
FIRESTONE DR
MEADOWDALE DR
HOWARD
LETTINGTON
CHILI AVE
BALTIMORE
MARIPOSA DR
WESTMAR DR
SIDE DRIVE
PIXLEY
CONRAIL
ROAD
14
2

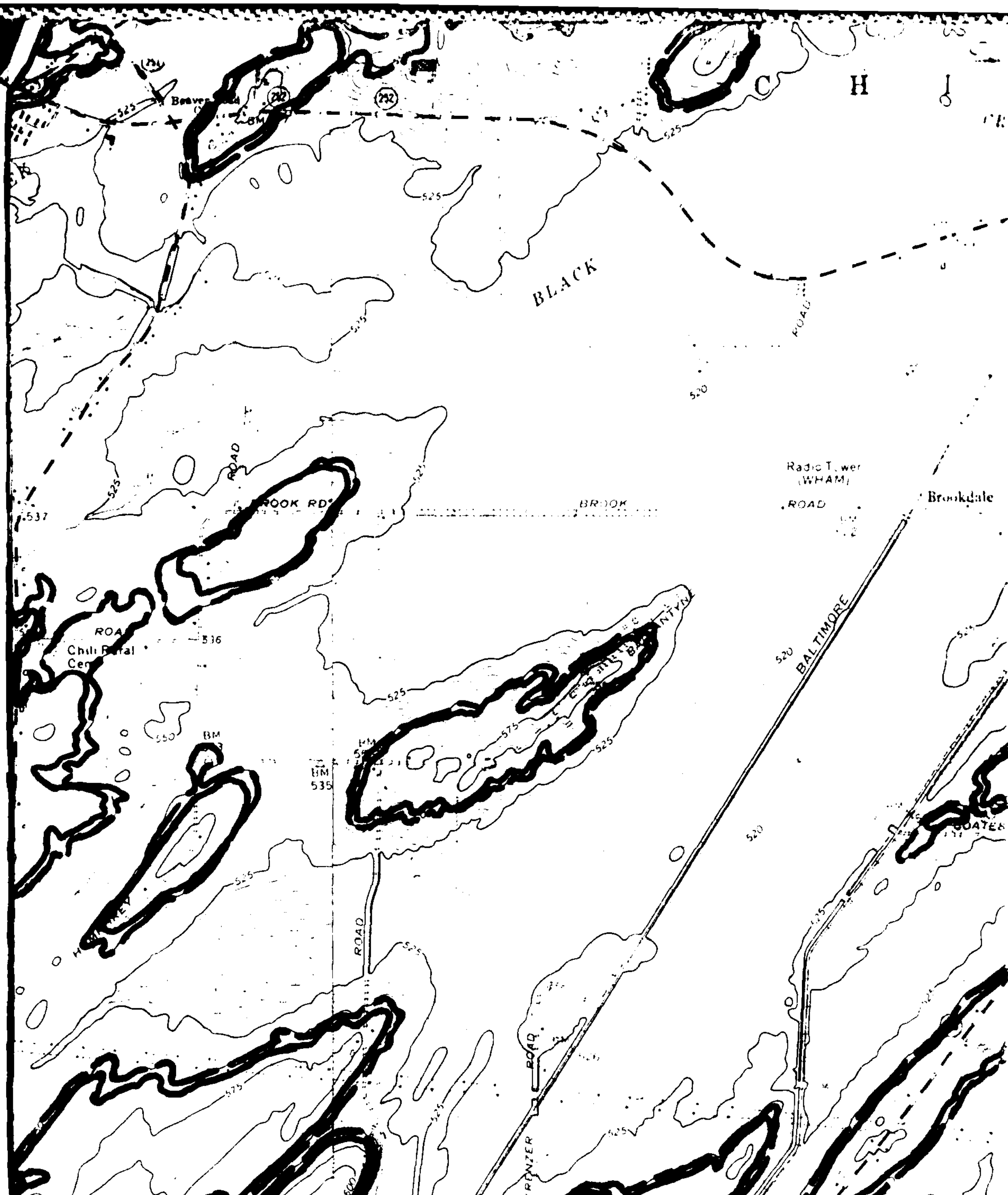


RIVER MILE = 14.3
DISTANCE FROM DAM = 52.6 MI.
SPILLWAY DESIGN FLOOD
W/O DAM FAILURE
W/DAM FAILURE
PEAK FLOOD TIME (HRS) 18.0 17.5
PEAK ELEV. 47.8 552.2
HINCHEY
ROAD
MEADOWDALE DR
HOWARD
LETTINGTON
AVE
TIMPAT
OHIO
BALTIMORE
AND
BROOKS AVE
ROCHESTER CORP BDY
ROCHESTER MONROE CO AIRPORT
RAVENWOOD
AVE
GENESEE
PARK
THURSTON
SAWYER
Sch No 16
Our Lady of Good Counsel
Sch
BROOKS
CONGRESS
Sch No 37
GENESEE
West Gate
CHILI
RIVER
Flow
GENESEE
12
14
383
547
552
558
Genesee Junction
ROCHESTER INSTITUTE OF TECHNOLOGY
3



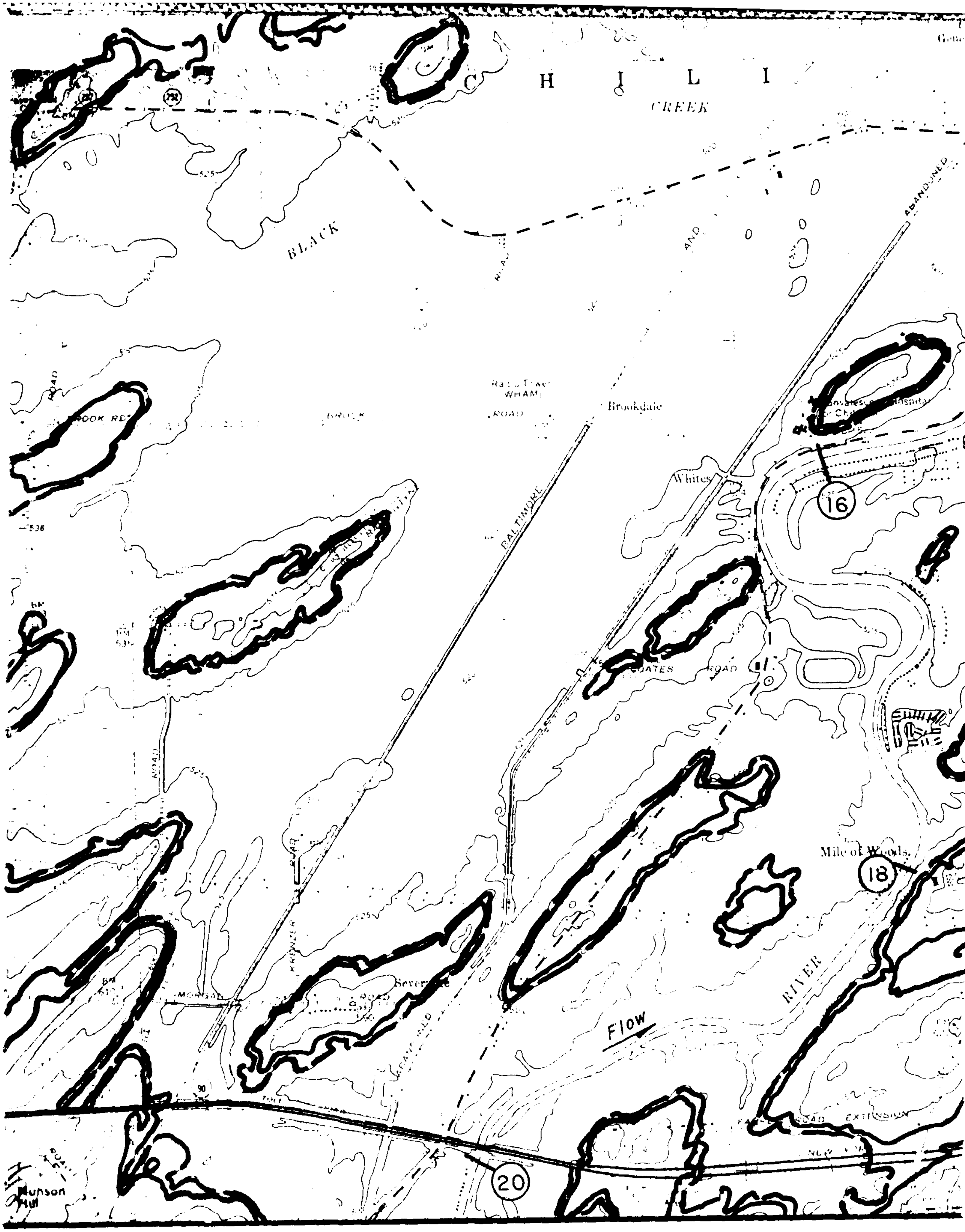
RIVER MILE
DISTANCE FROM DAM
SPILLWAY DESIGN
W/O DAM FAILURE | W/DAM
PEAK FLOOD TIME(HRS) 19.0
PEAK ELEV.(FT) 543.1
RIVER
GENESEE
10
ROCHESTER
West Brighton
ROCHESTER
Flow
12
B R I G H T O N
4

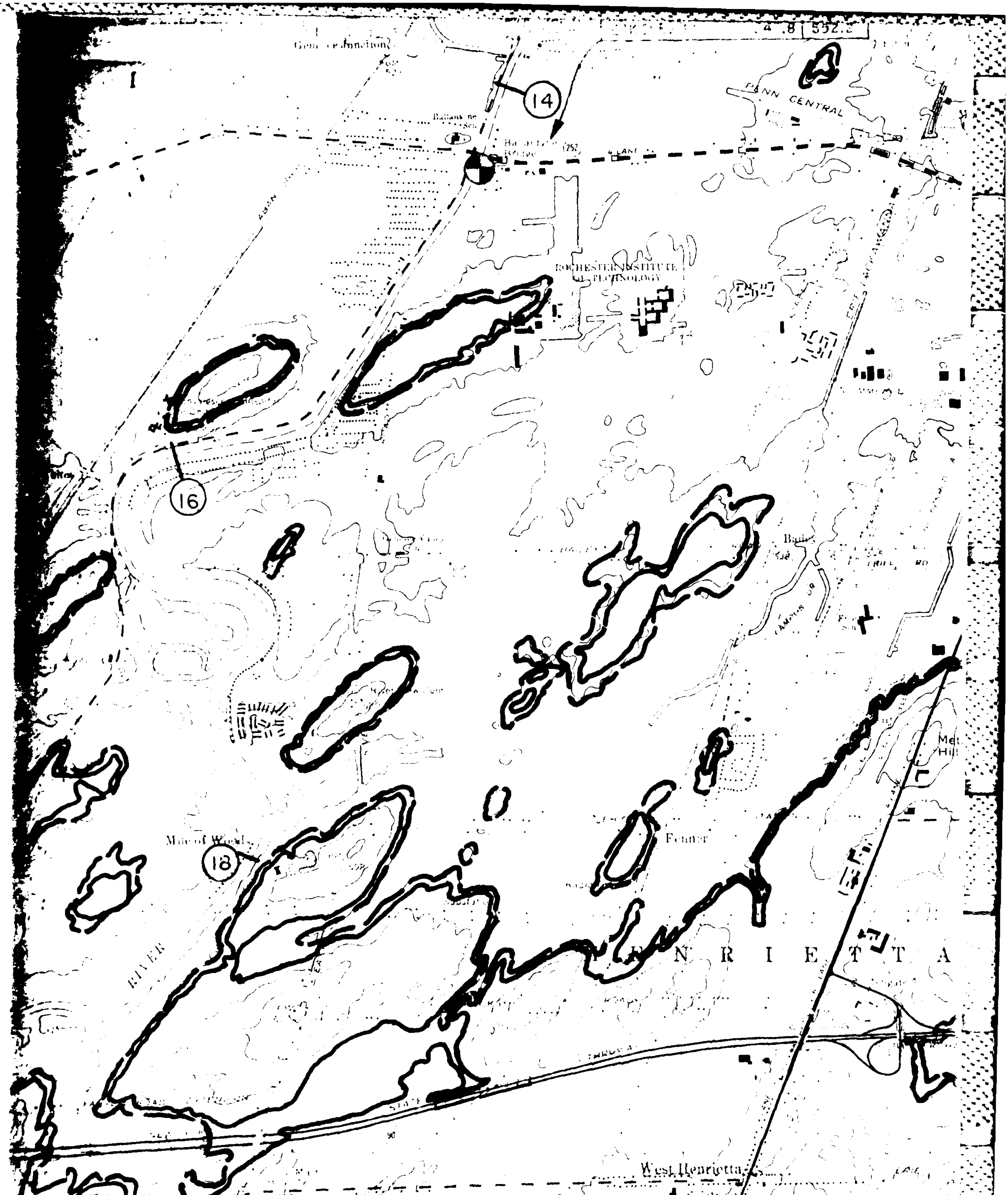

Cobbs Hill
Reservoir
Radio Tower
Twelve
Corners
BM491
Corner
Jr High Sc
B R I G H T O N
DRIVE
STREET
BM
469
450
French Road
ELEV
486
CANAL
WARREN
5



C H I
BLACK
Radio Tower (WHAM)
BROOK ROAD
Brookdale
BROOK RD
ROAD
Chili Rural Cem
BALTIMORE
ROAD
FRONTIER
MORGAN
Severne
ABANDONED
Flow
Munson Hill
20
90

6

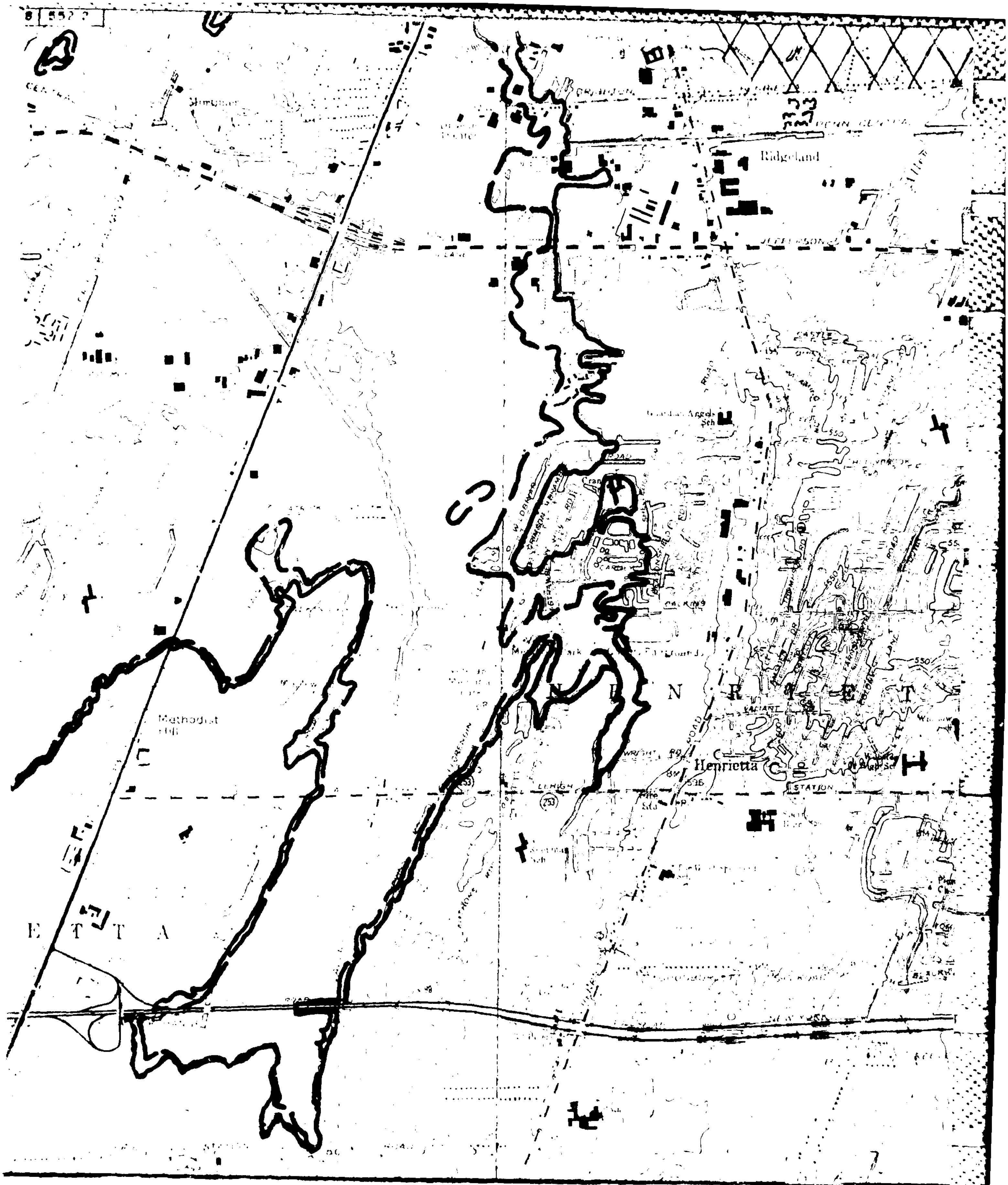

CHILI
CREEK
BLACK
Brookdale
BROOK RD
BALTIMORE
Whites
16
COATES ROAD
Mile of Woods
18
RIVER
FLOW
MORGAN
ROAD
ABANDONED
FARM ROAD EXTENSION
20
90
Munson Hill
7



552
14
PENN CENTRAL
ROCHESTER INSTITUTE OF TECHNOLOGY
16
18
Mile of Woods
Fenner
RIVER
N R I E T T A
West Henrietta

8

9



Ridgeland
PENN CENTRAL
Methodist Hill
Henrietta
Fairgrounds
LEHIGH
STATION
WRIGHT RD
550
536
253
E T T A
N R E T

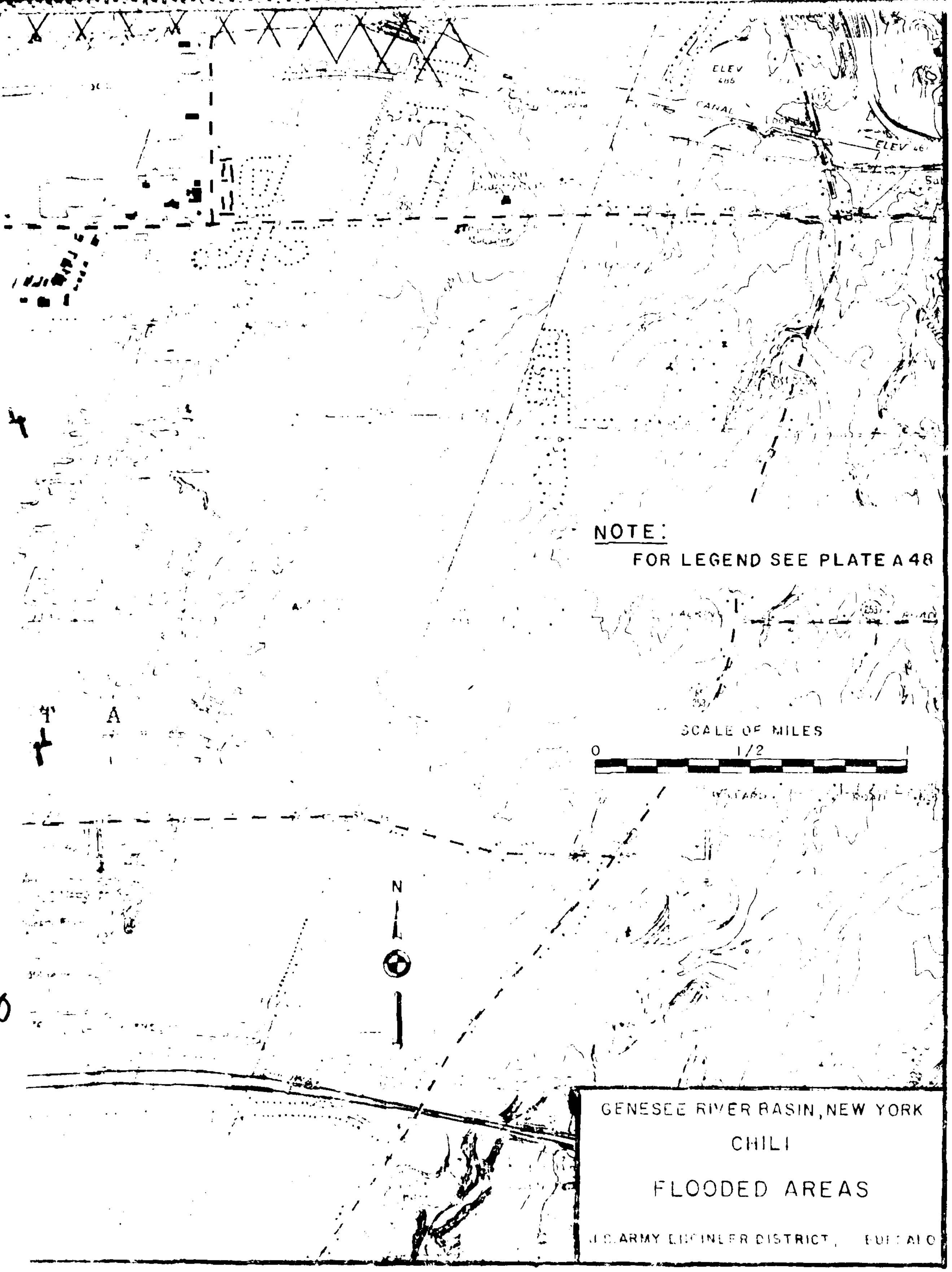
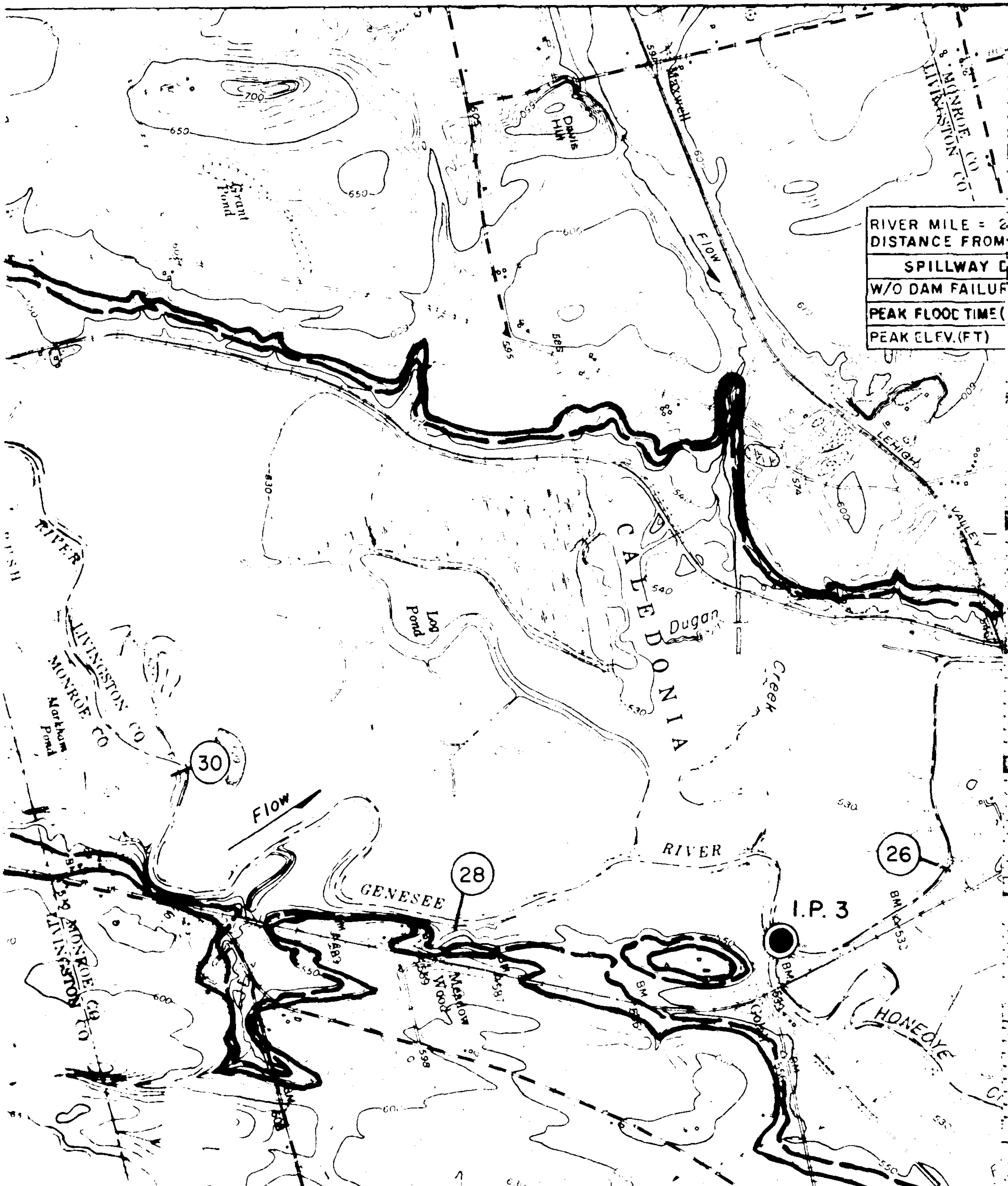
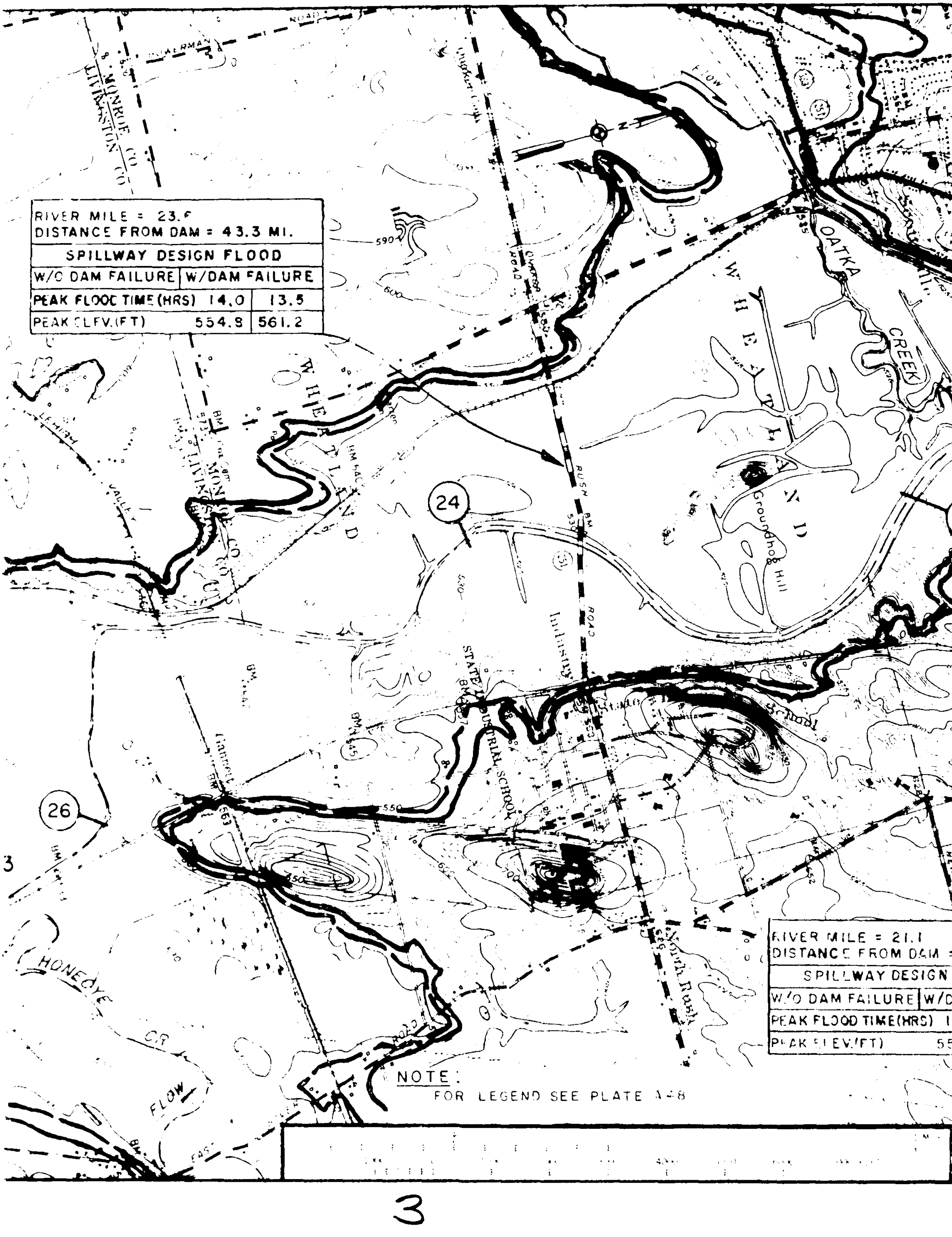

ELEV
CANAL
ELEV
NOTE:
FOR LEGEND SEE PLATE A48
SCALE OF MILES
0
1/2
1
N
GENESEE RIVER BASIN, NEW YORK
CHILI
FLOODED AREAS
U.S. ARMY ENGINEER DISTRICT, BUFFALO

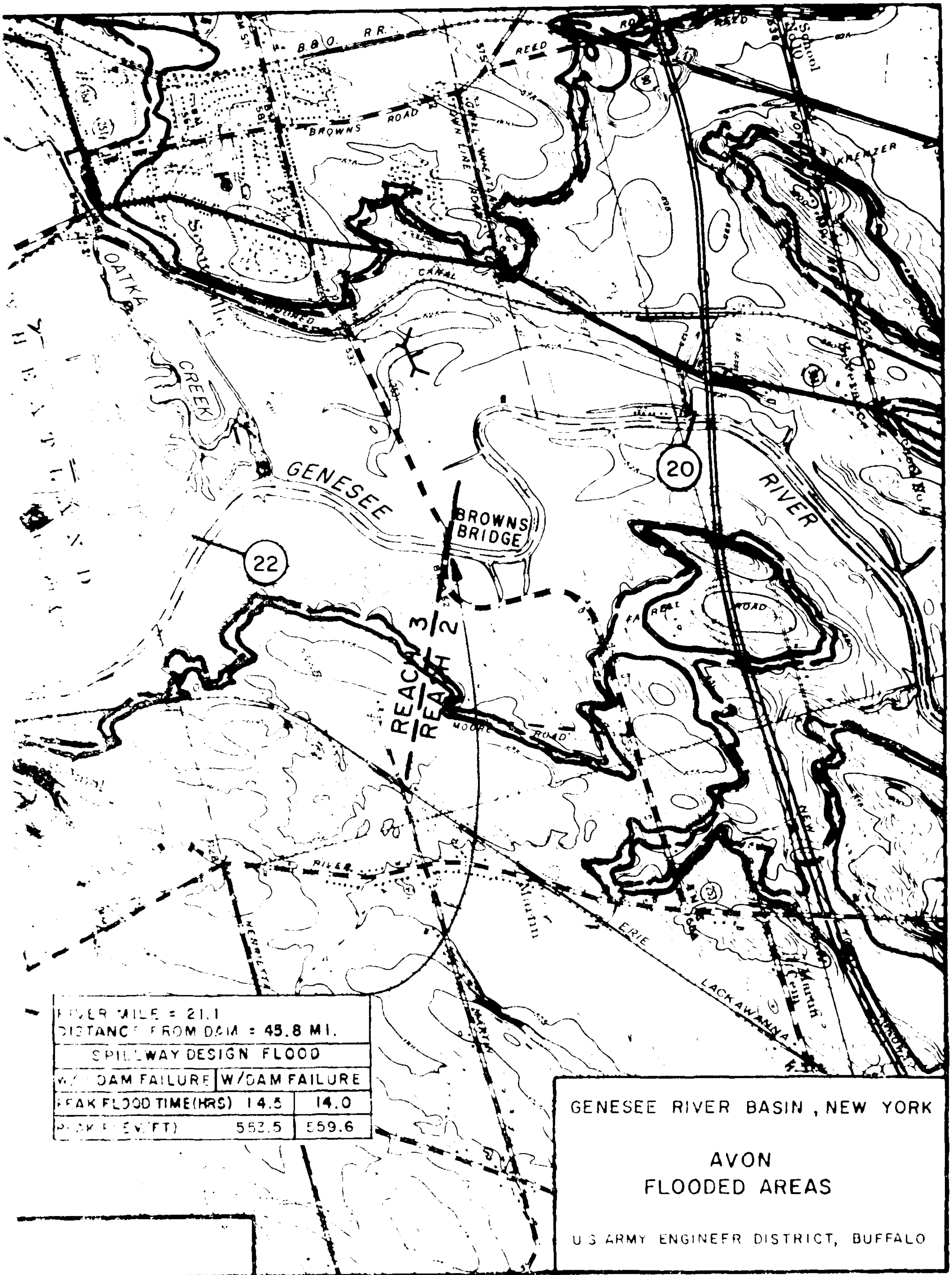
PLATE A49


Finnegan Hill
PENN CENTRAL
GENESEE
ERIE LACKAWANNA
REACH 4
REACH 3
36
34
32
30
RUSH
RIVER
LIVINGSTON CO
MONROE CO
Horseshoe Pond
Markham Pond
ERIE
LACKAWANNA
Avon
MONROE CO
LIVINGSTON CO
RIVER MILE = 35.2
DISTANCE FROM DAM = 31.7 MI.
SPILLWAY DESIGN FLOOD
W/O DAM FAILURE
12.0
11.0
565.8

1


RIVER MILE = 2
DISTANCE FROM
SPILLWAY D
W/O DAM FAILUF
PEAK FLOOD TIME(
PEAK ELEV.(FT)
700
650
Grant Pond
Davis Hill
Maxwell
Flow
MONROE CO
LIVINGSTON CO
LEHIGH
VALLEY
CALEDONIA
Dugan
Creek
Log Pond
RIVER
LIVINGSTON CO
MONROE CO
Markham Pond
30
Flow
28
GENESEE
RIVER
26
I.P. 3
Meadow Wood
HONEOYE
MONROE CO
LIVINGSTON CO


RIVER MILE = 23.6
DISTANCE FROM DAM = 43.3 MI.
SPILLWAY DESIGN FLOOD
W/O DAM FAILURE
W/DAM FAILURE
PEAK FLOOD TIME (HRS) 14.0 13.5
PEAK ELEV. (FT) 554.8 561.2
RIVER MILE = 21.1
DISTANCE FROM DAM =
SPILLWAY DESIGN
W/O DAM FAILURE
PEAK FLOOD TIME (HRS)
PEAK ELEV. (FT)
24
26
OATKA
CREEK
WHEATLAND
Groundhog Hill
STATE INDUSTRIAL SCHOOL
HONEOYE
CR
FLOW
RUSH
ROAD
MONROE CO
LIVINGSTON CO
VALLEY
NOTE:
FOR LEGEND SEE PLATE A-8

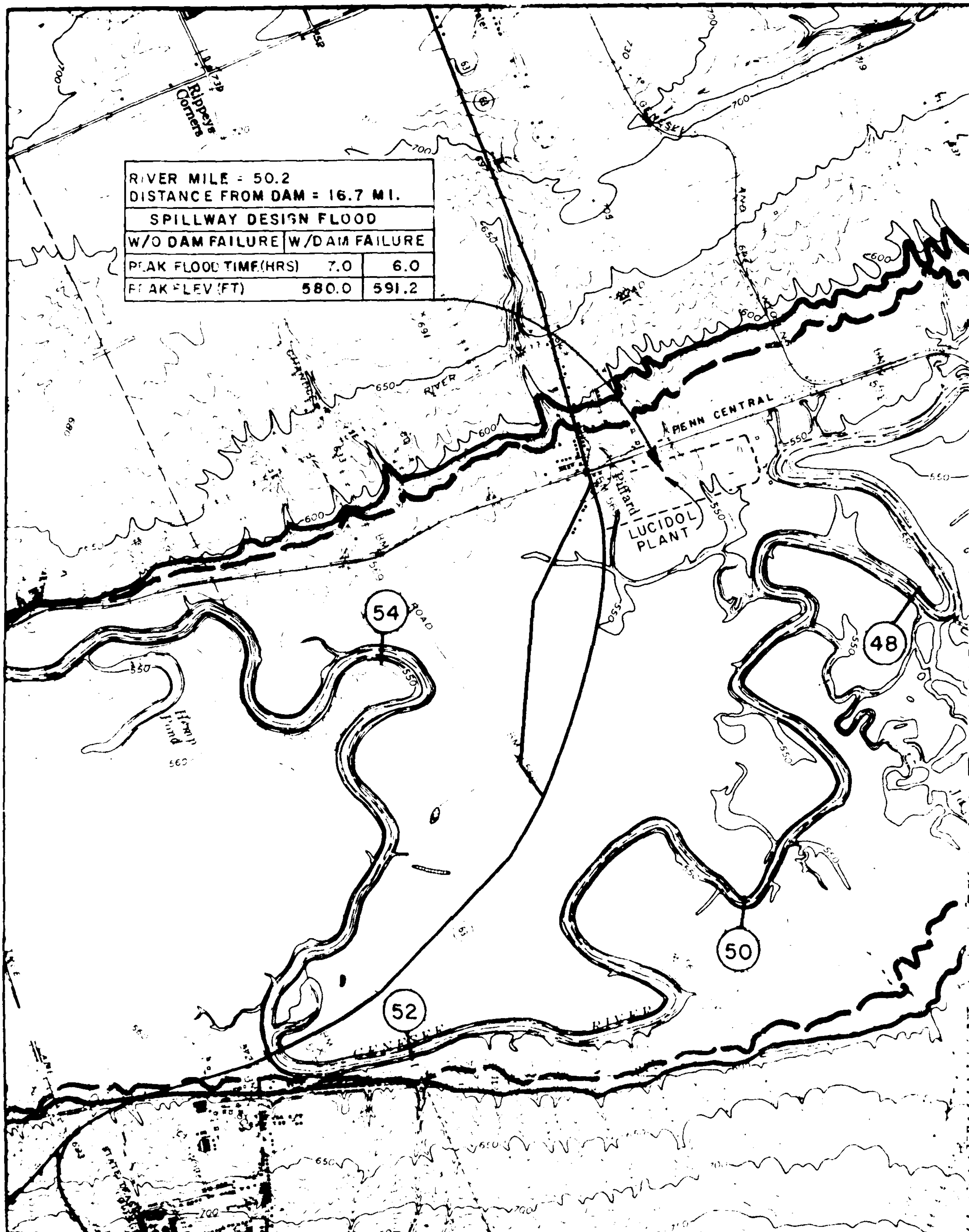


RIVER MILE = 21.1		
DISTANCE FROM DAM = 45.8 MI.		
SPILLWAY DESIGN FLOOD		
	W/O DAM FAILURE	W/DAM FAILURE
PEAK FLOOD TIME(HRS)	14.5	14.0
PEAK ELEV(FT)	553.5	559.6

GENESEE RIVER BASIN, NEW YORK

AVON
FLOODED AREAS

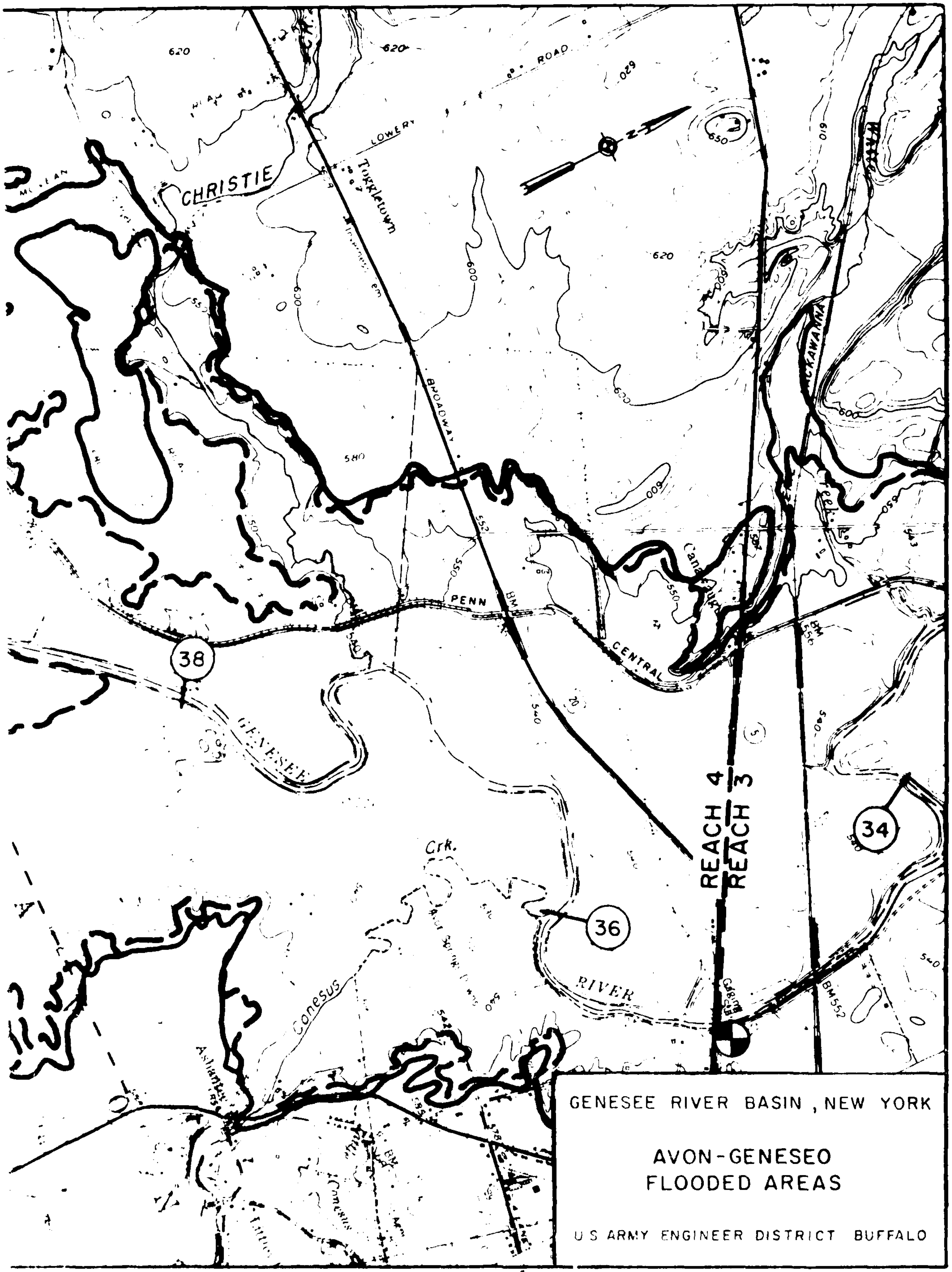
U.S. ARMY ENGINEER DISTRICT, BUFFALO



RIVER MILE = 50.2	
DISTANCE FROM DAM = 16.7 MI.	
SPILLWAY DESIGN FLOOD	
W/O DAM FAILURE	W/DAM FAILURE
PEAK FLOOD TIME (HRS) 7.0	6.0
PEAK ELEV (FT) 580.0	591.2

2

40
42
I.P. 4
RIVER
ROAD
ROAD
BOYD
580
590
600
LEGEND SEE PLATE A 18



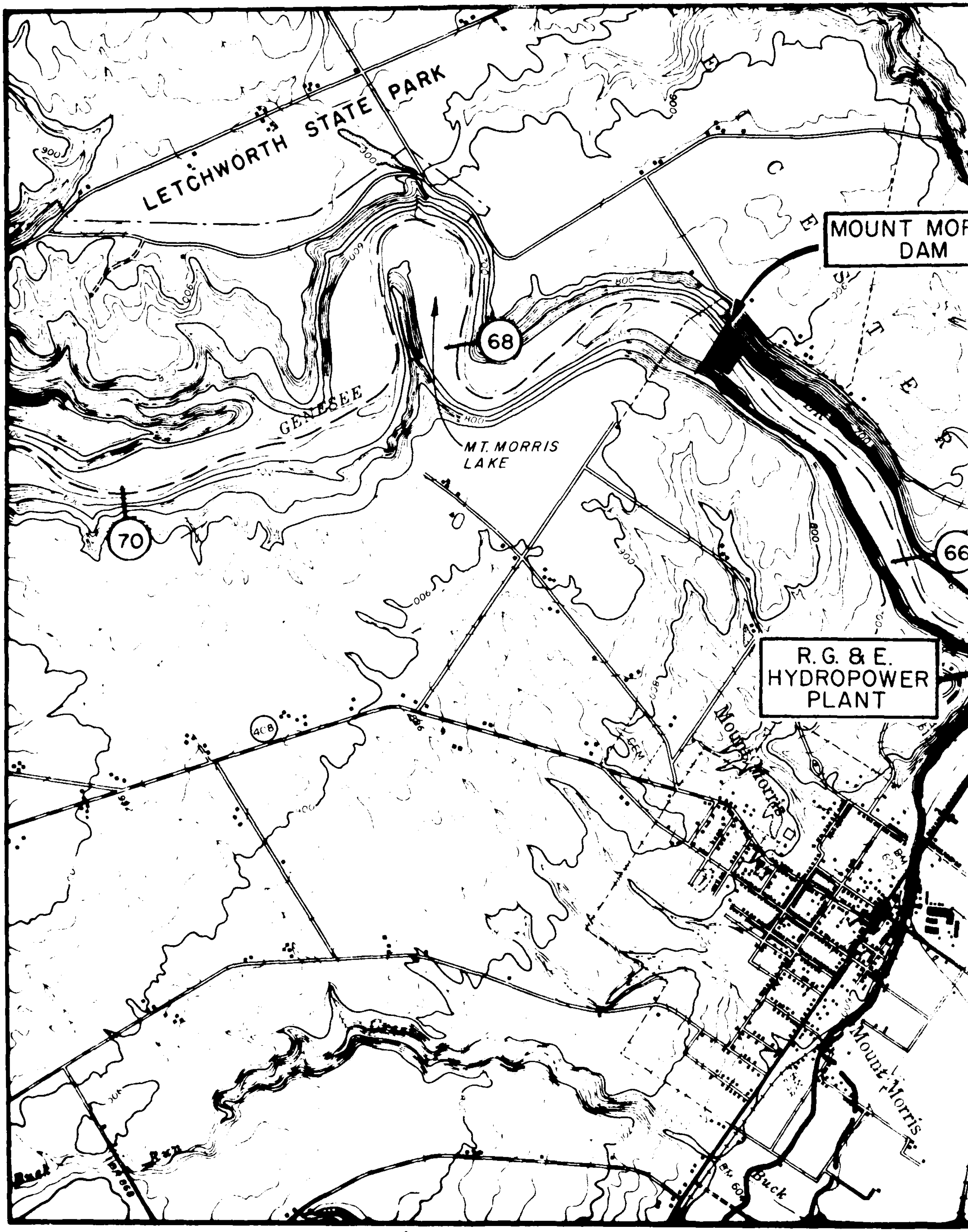
GENESEE RIVER BASIN, NEW YORK

AVON-GENESEO
FLOODED AREAS

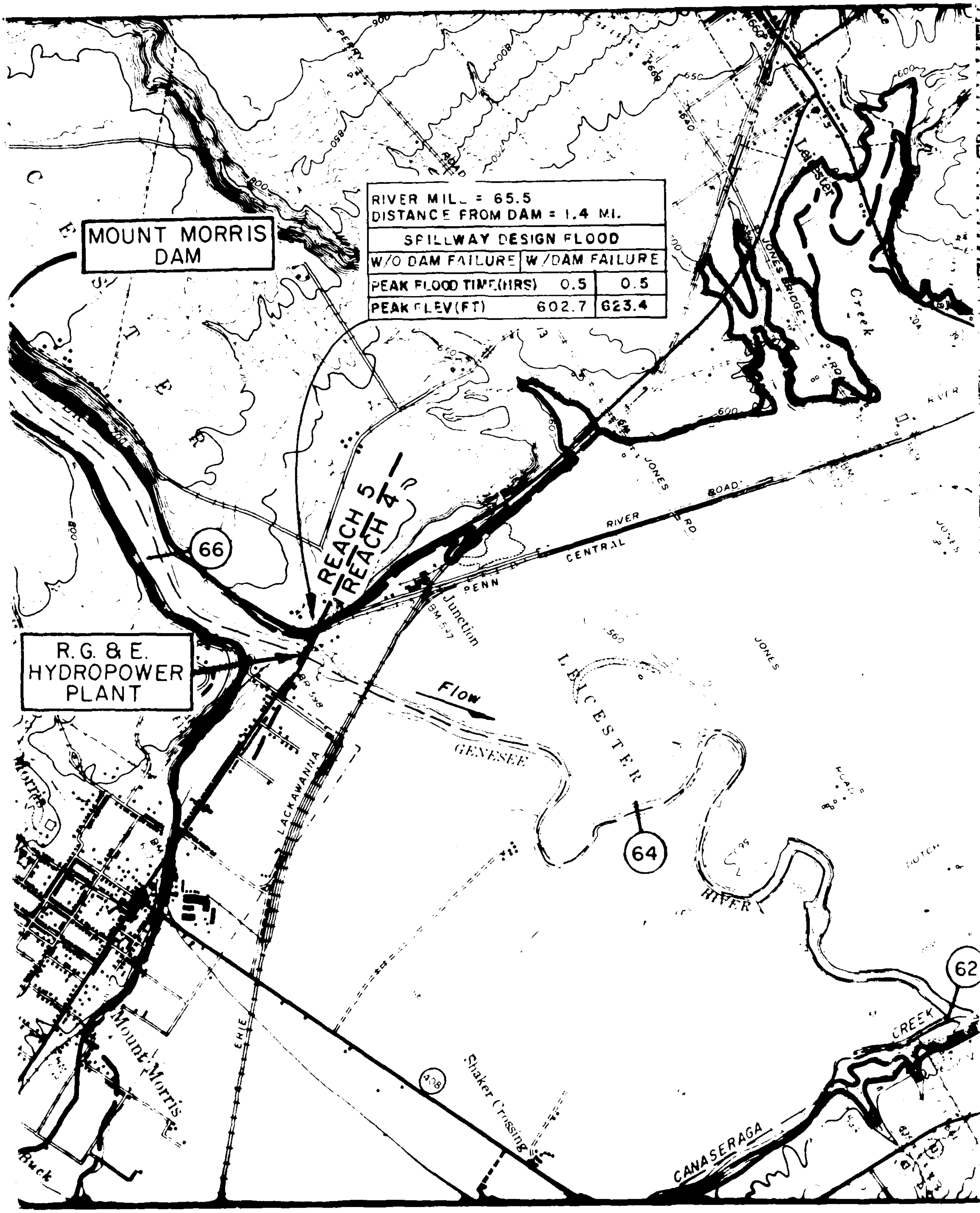
U.S. ARMY ENGINEER DISTRICT BUFFALO

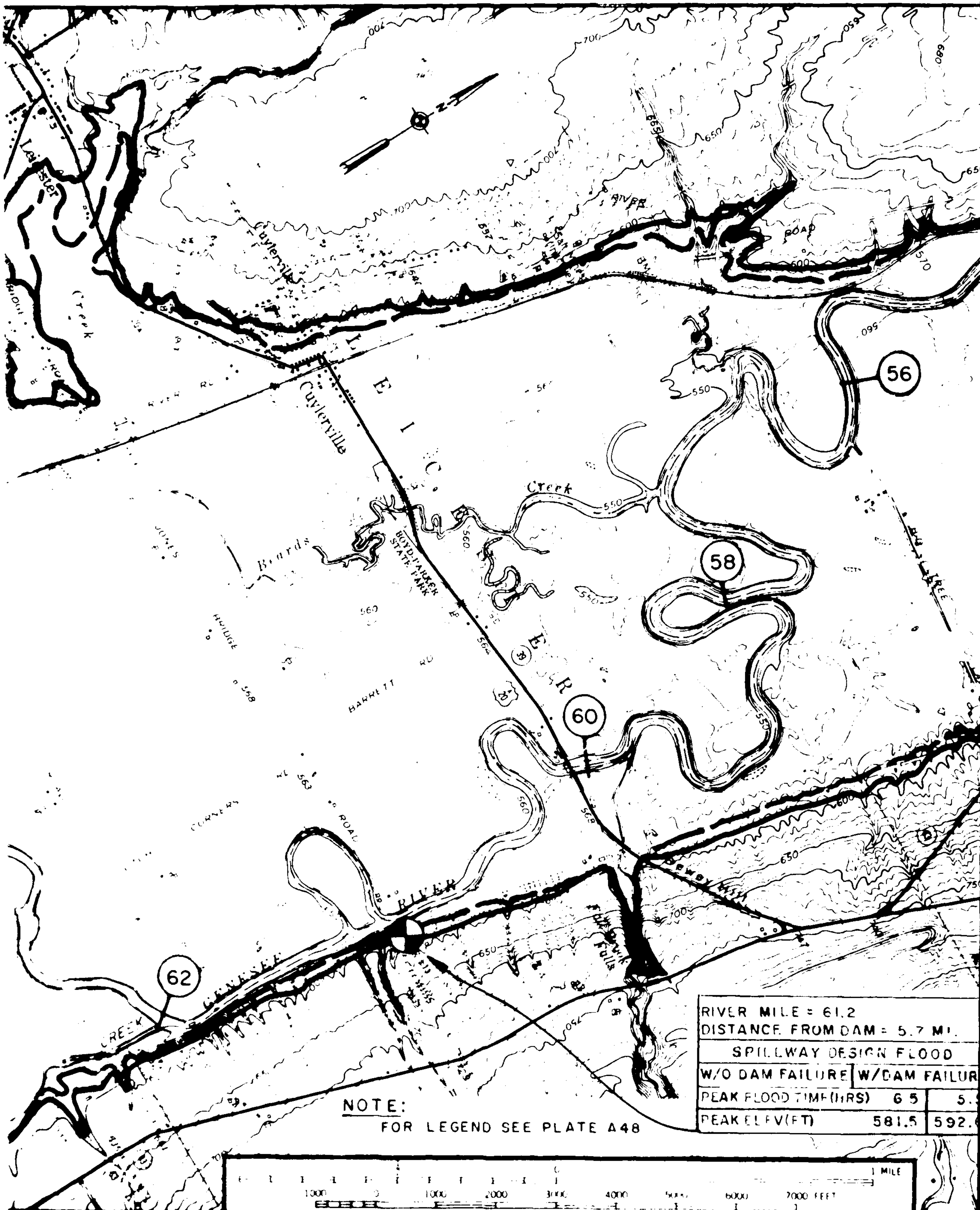
PLATE A51

4

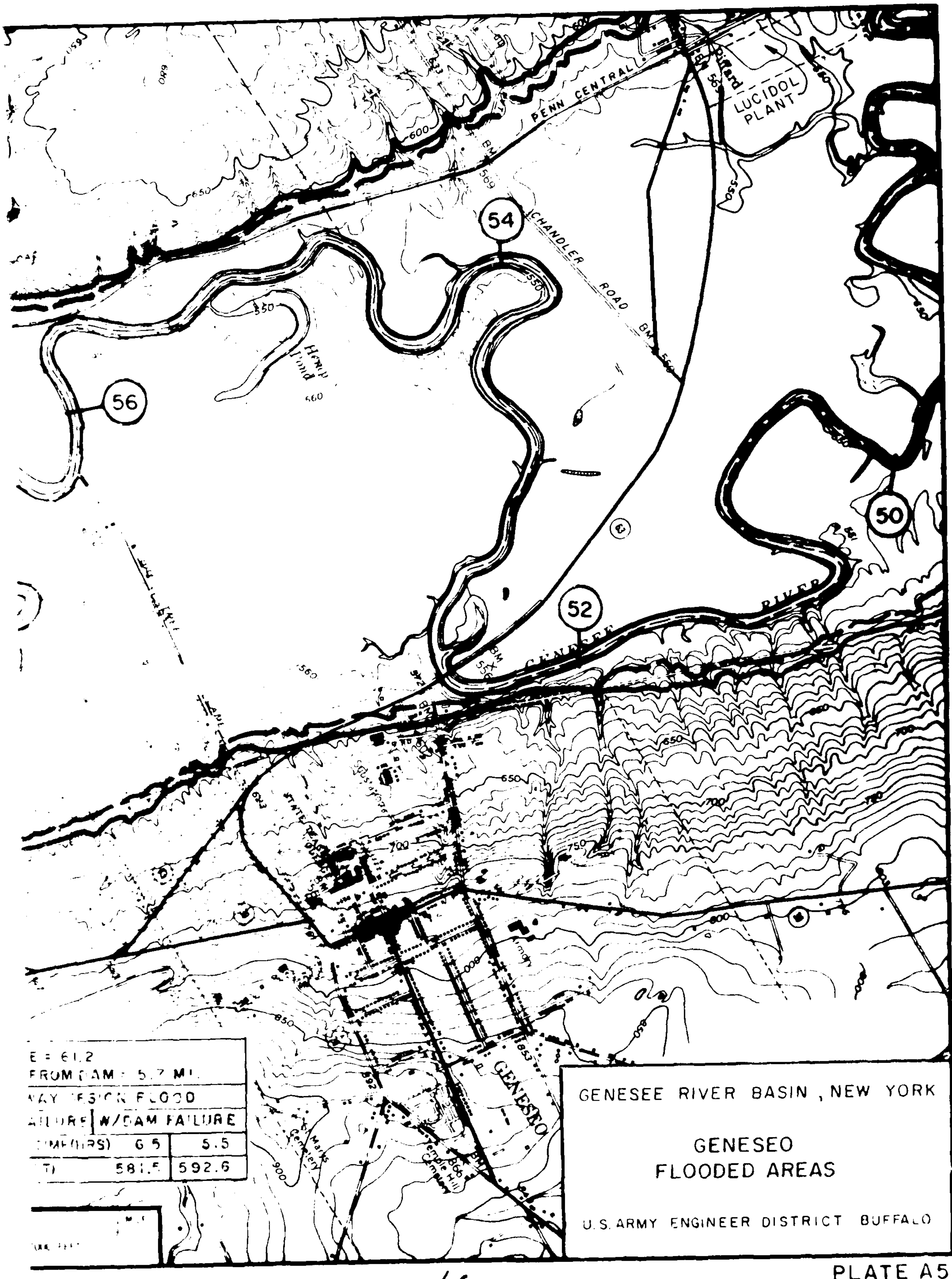

LETCHWORTH STATE PARK
MOUNT MOF
DAM
68
GENESEE
MT. MORRIS
LAKE
70
66
R. G. & E.
HYDROPOWER
PLANT
408
Mount Morris
Mount Morris
Buck

1

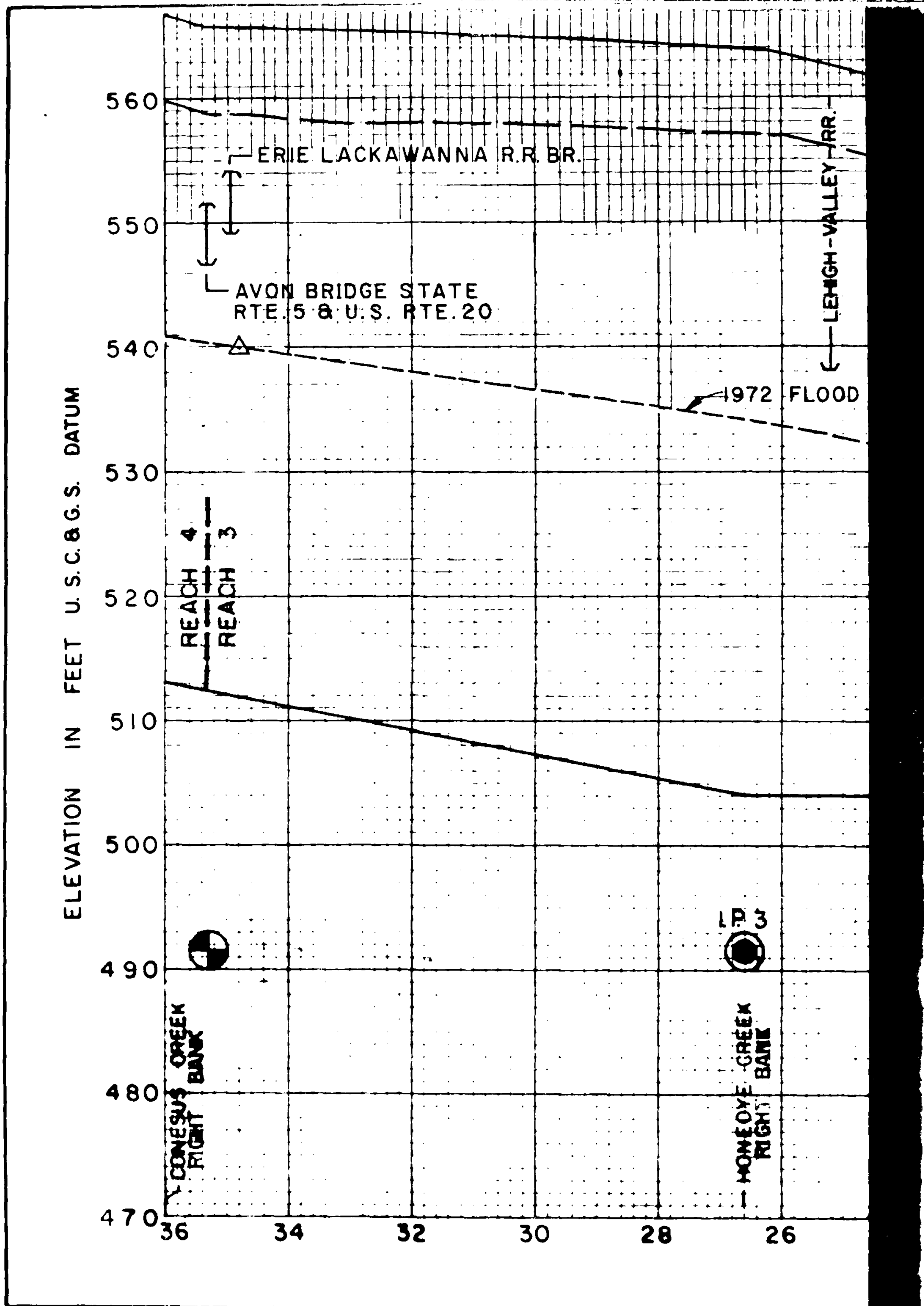

RIVER MILE = 65.5
DISTANCE FROM DAM = 1.4 MI.
SPILLWAY DESIGN FLOOD
W/O DAM FAILURE
W/DAM FAILURE
PEAK FLOOD TIME(HRS) 0.5 0.5
PEAK ELEV(FT) 602.7 623.4
MOUNT MORRIS DAM
R.G. & E. HYDROPOWER PLANT
REACH 5
REACH 4
66
64
62
Flow
GENESEE
RIVER
LEICESTER
Junction
LACKAWANNA
ERIE
Mount Morris
Shaker Crossing
408
CANASERAGA
CREEK
CENTRAL
PENN
JONES BRIDGE
Creek


RIVER MILE = 61.2
DISTANCE FROM DAM = 5.7 MI.
SPILLWAY DESIGN FLOOD
W/O DAM FAILURE
W/DAM FAILUR
PEAK FLOOD TIME(HRS) 6.5
PEAK ELEV(FT) 581.5 592.
NOTE:
FOR LEGEND SEE PLATE A48
56
58
60
62
Cuylerville
BOYD-PARKER STATE PARK
Creek
Boards
GENESEE
RIVER
CREEK
BARRETT RD
CORNERS ROAD
1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

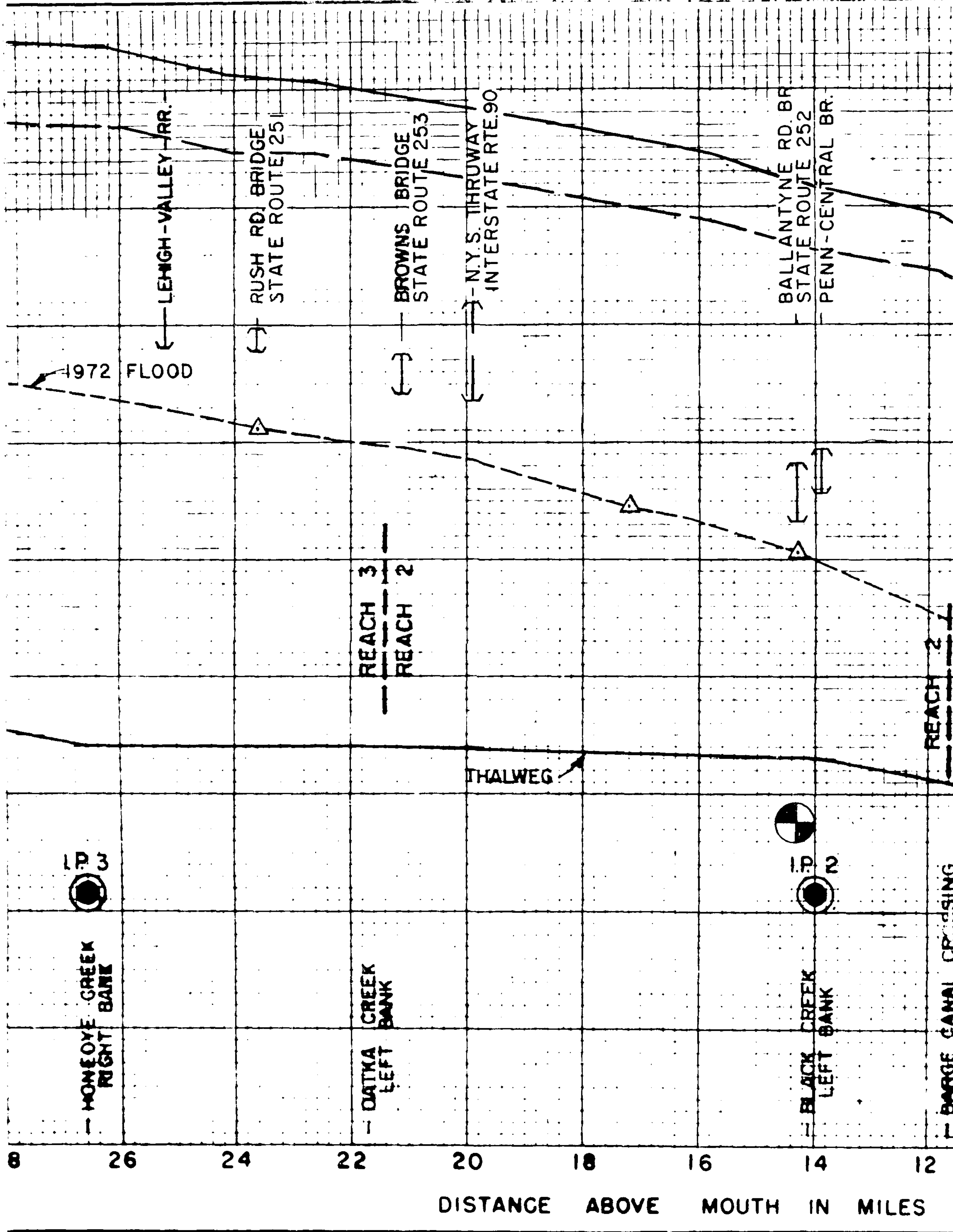
3

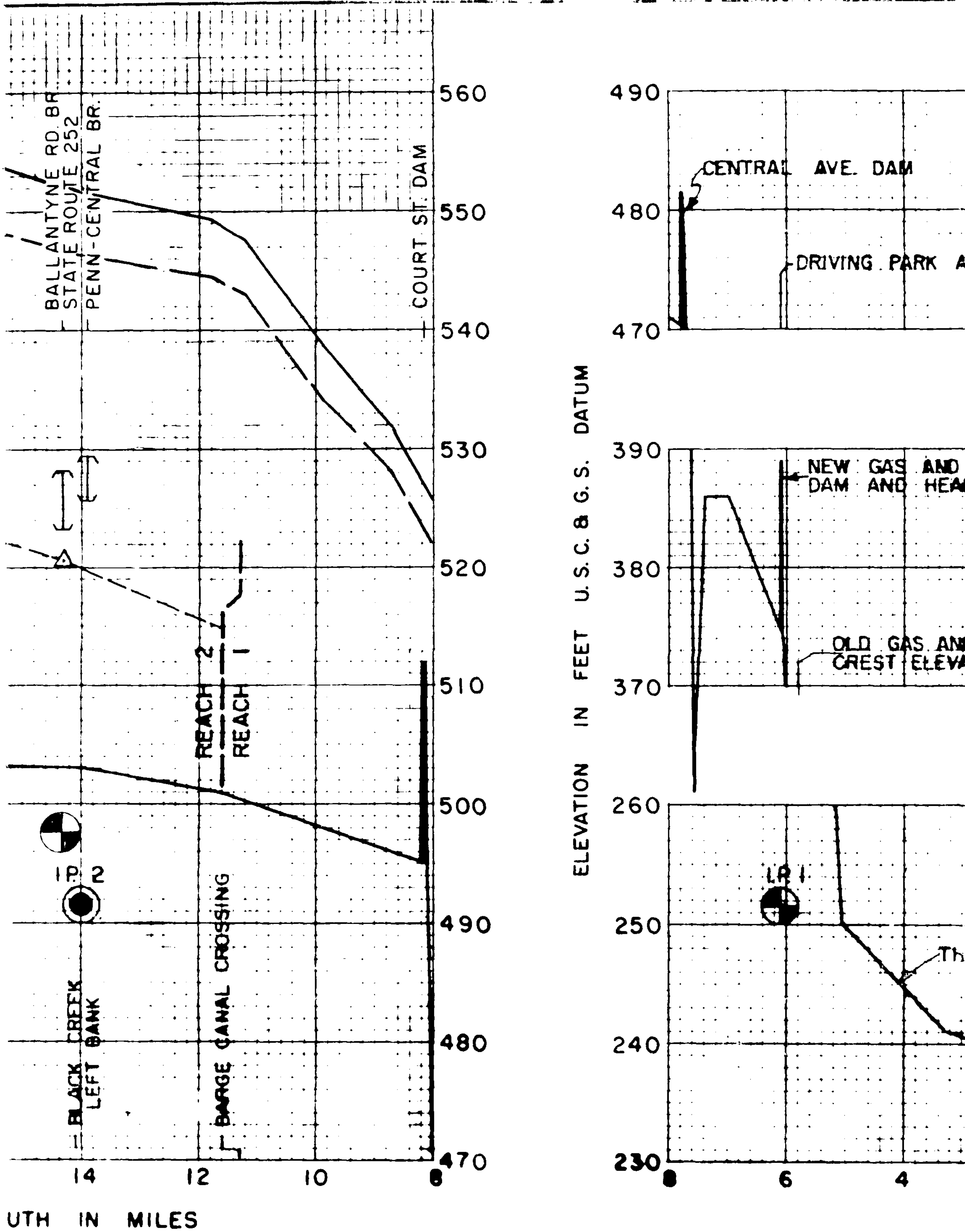


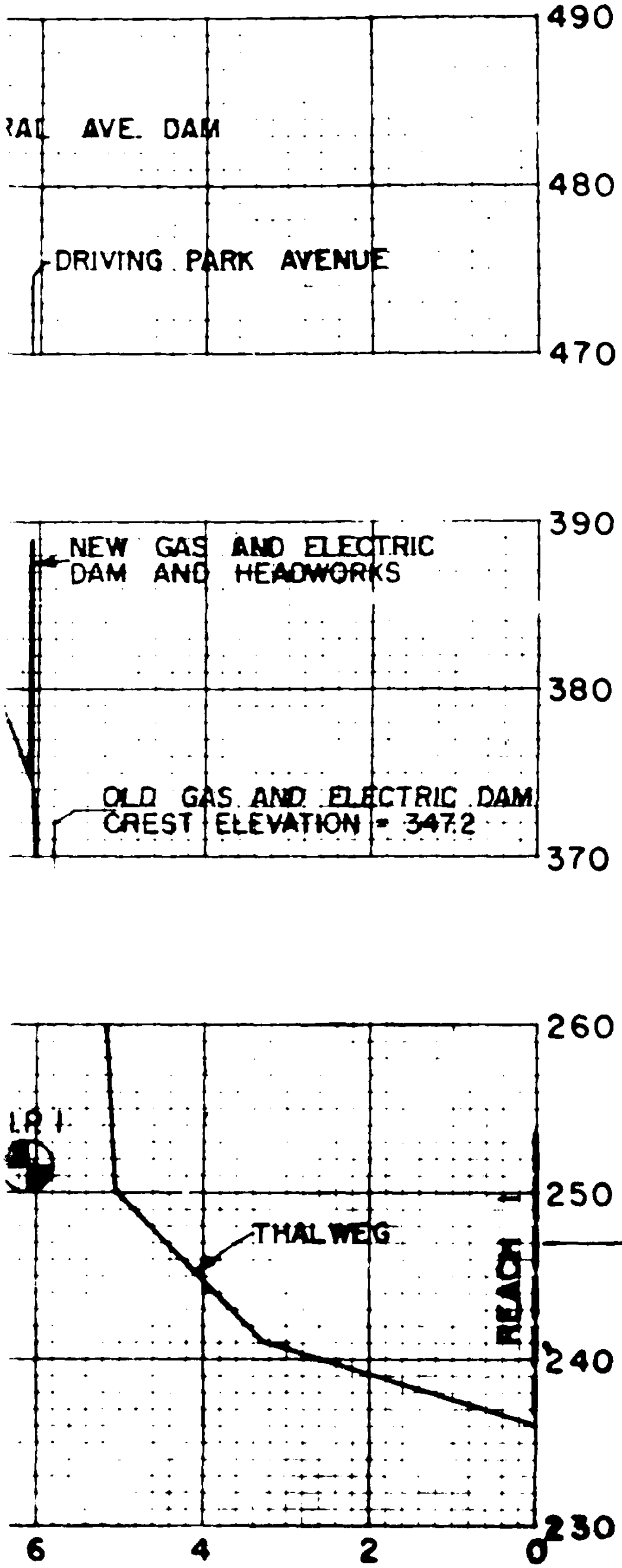
GENESEE RIVER BASIN , NEW YORK
GENESEO
FLOODED AREAS
U.S. ARMY ENGINEER DISTRICT BUFFALO
PENN CENTRAL
LUCIDOL PLANT
CHANDLER ROAD
GENESEE RIVER
GENESEO
54
56
52
50
650
600
550
560
700
750
E = 61.2
FROM DAM = 5.7 MI.
AILURE
W/DAM FAILURE
6.5
5.5
581.5
592.6



ELEVATION IN FEET U.S.C.&G.S. DATUM
560
550
540
530
520
510
500
490
480
470
36
34
32
30
28
26
ERIE LACKAWANNA R.R. BR.
AVON BRIDGE STATE RTE. 5 & U.S. RTE. 20
LEHIGH-VALLEY RR.
1972 FLOOD
REACH 4
REACH 3
I.P. 3
CONESUS CREEK RIGHT BANK
HONEOYE CREEK RIGHT BANK


LEHIGH-VALLEY RR.
RUSH RD. BRIDGE
STATE ROUTE 251
BROWNS BRIDGE
STATE ROUTE 253
N.Y.S. THRUWAY
INTERSTATE RTE.90
BALLANTYNE RD. BR.
STATE ROUTE 252
PENN-CENTRAL BR.
1972 FLOOD
REACH 3
REACH 2
REACH 2
REACH 1
THALWEG
I.P. 3
I.P. 2
HONEOYE CREEK
RIGHT BANK
OATKA CREEK
LEFT BANK
BLACK CREEK
LEFT BANK
BARGE CANAL CROSSING
8
26
24
22
20
18
16
14
12
DISTANCE ABOVE MOUTH IN MILES


BALLANTYNE RD. BR.
STATE ROUTE 252
PENN-CENTRAL BR.
COURT ST. DAM
REACH 2
REACH 1
IP 2
BLACK CREEK
LEFT BANK
BARGE CANAL CROSSING
CENTRAL AVE. DAM
DRIVING PARK A
NEW GAS AND
DAM AND HEA
OLD GAS AN
CREST ELEVA
IP 1
Th
ELEVATION IN FEET U.S.C.&G.S. DATUM
560
550
540
530
520
510
500
490
480
470
390
380
370
260
250
240
230
14
12
10
8
6
4
UTH IN MILES



LEGEND:

U.S.G.S. RECORDING GAGE

I.P.2 INDEX POINT REACH 2

HIGH WATER MARK

APPROXIMATE FLOOR EL.

APPROXIMATE LOW CHORD EL.

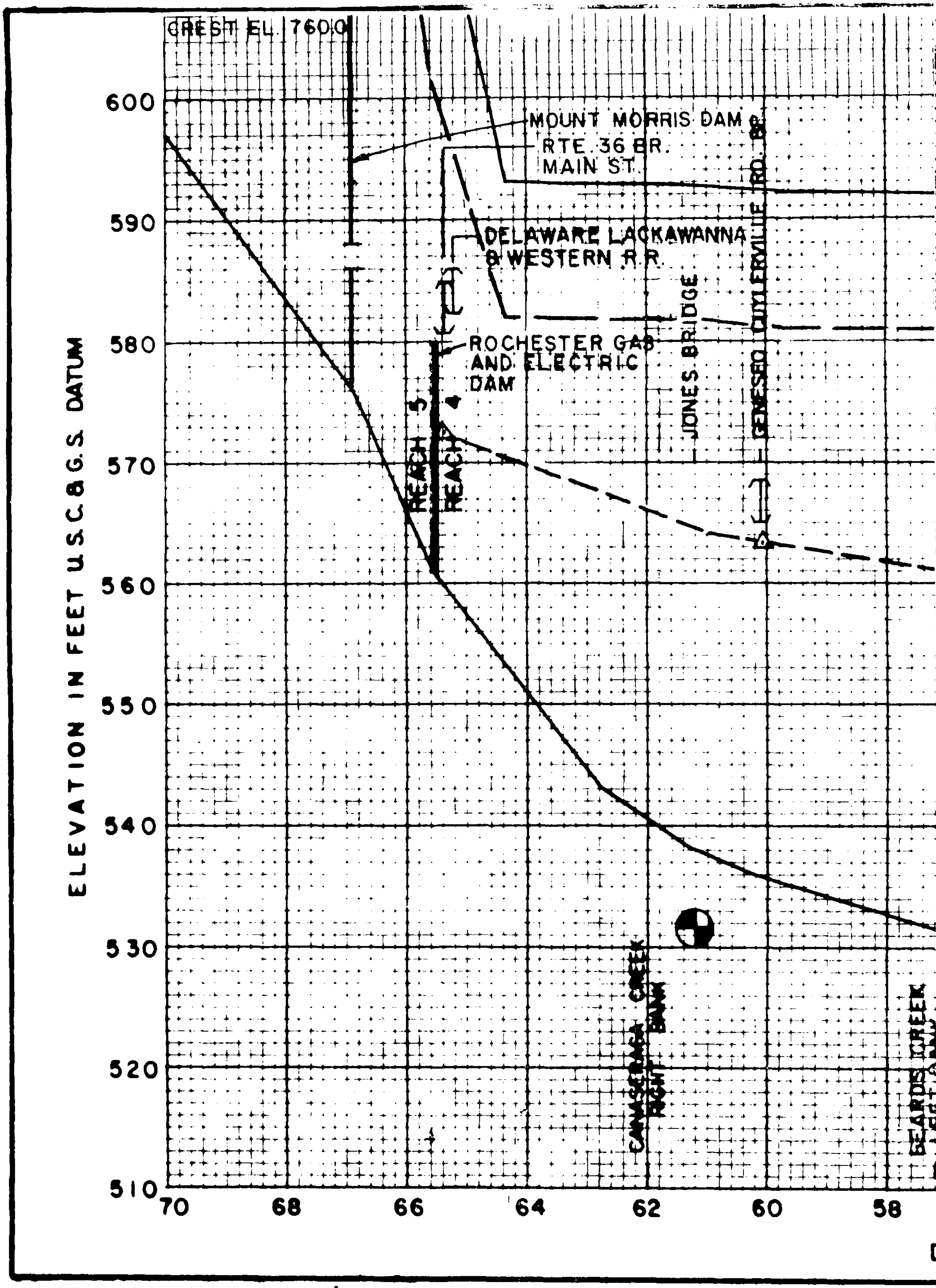
PROBABLE MAXIMUM FLOOD WITH DAM FAILURE.

PROBABLE MAXIMUM FLOOD WITHOUT DAM FAILURE.

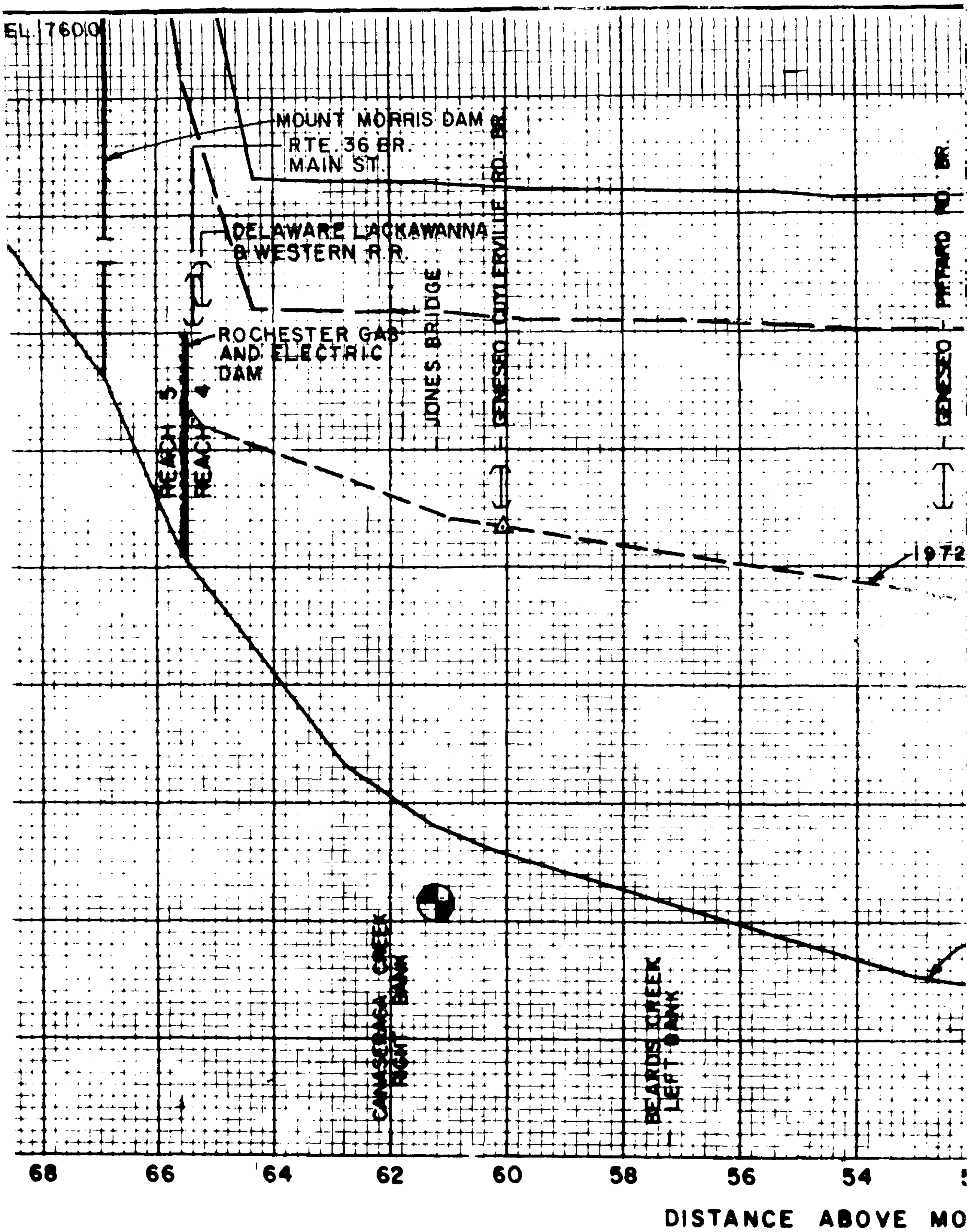
GENESEE RIVER BASIN, NEW YORK

PROFILES
GENESEE RIVER
MILE 0 TO 36

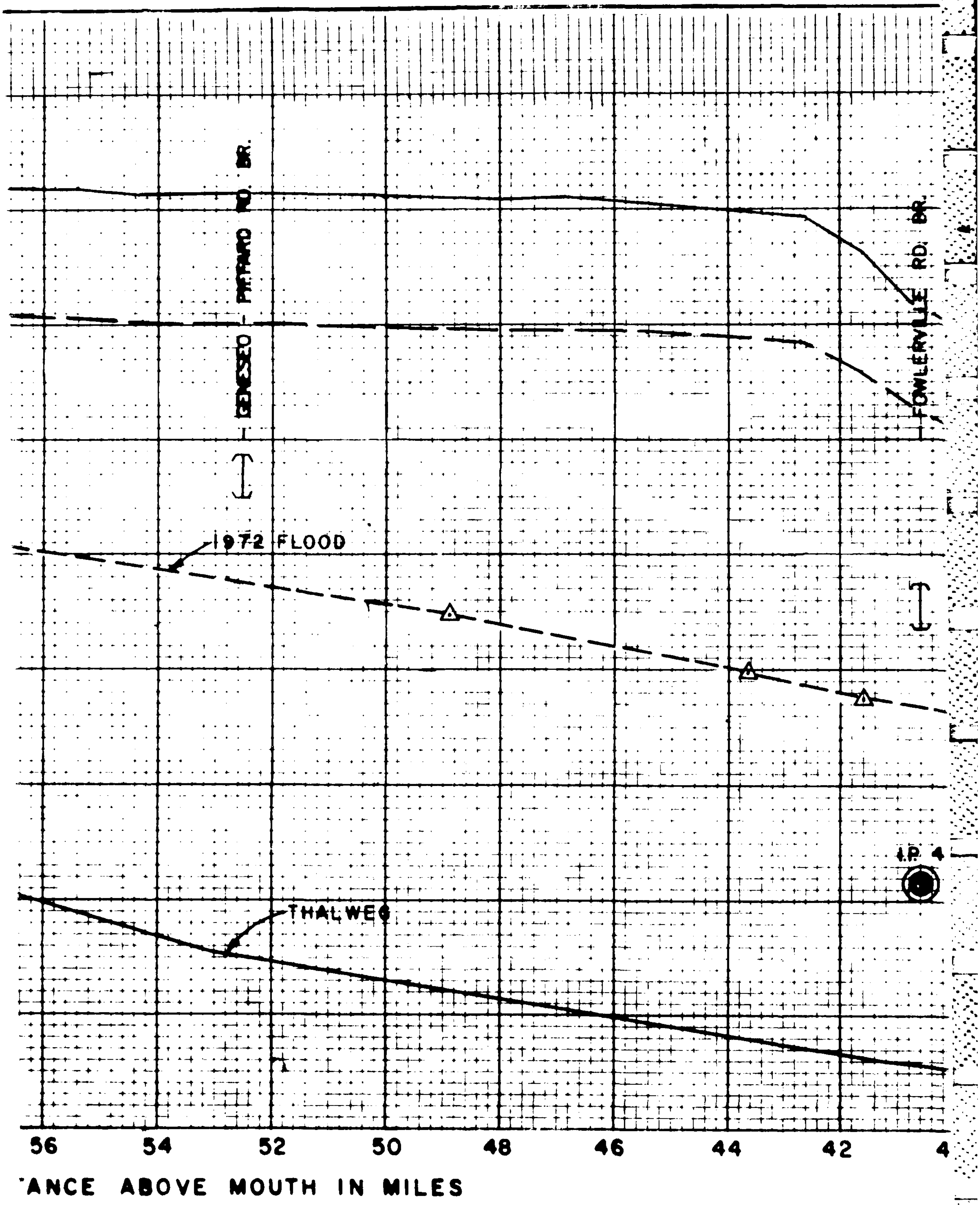
U.S. ARMY ENGINEER DISTRICT, BUFFALO



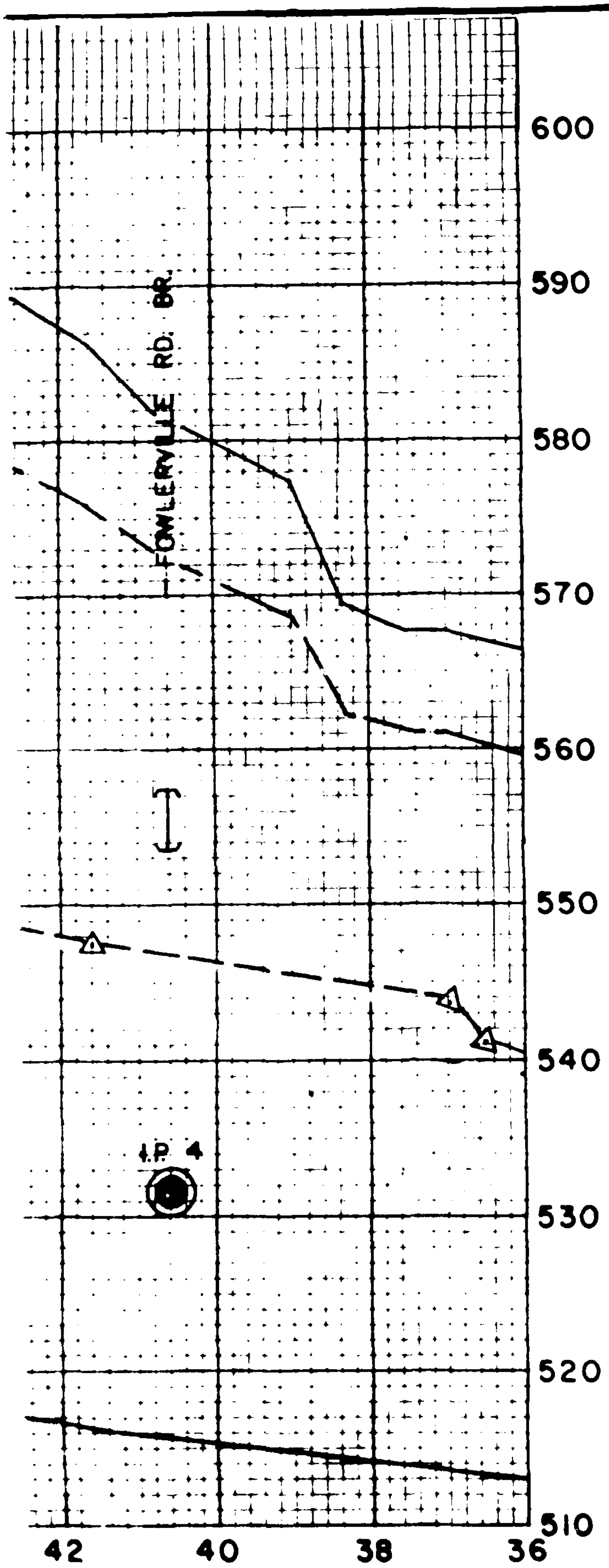
CREST EL. 760.0
MOUNT MORRIS DAM
RTE. 36 BR. MAIN ST.
DELAWARE LACKAWANNA & WESTERN R.R.
ROCHESTER GAS AND ELECTRIC DAM
REACH 5
REACH 4
JONES BRIDGE
GENESEO CUYLERVILLE RD.
CANASERAGA CREEK RIGHT BANK
BEARDS CREEK
ELEVATION IN FEET U.S.C.&G.S. DATUM
600
590
580
570
560
550
540
530
520
510
70
68
66
64
62
60
58



EL 760.0
MOUNT MORRIS DAM
RTE. 36 BR.
MAIN ST.
DELAWARE LACKAWANNA
& WESTERN R.R.
ROCHESTER GAS
AND ELECTRIC
DAM
REACH 5
REACH 4
JONES BRIDGE
GENESEO CUYLERVILLE RD. BR.
GENESEO PIFFARD RD. BR.
1972
CANASERAGA CREEK
RIGHT BANK
BEARDS CREEK
LEFT BANK
68
66
64
62
60
58
56
54
DISTANCE ABOVE MO



GENESEO - PIFFARD RD. BR.
FOWLERVILLE RD. BR.
1972 FLOOD
THALWEG
I.P. 4
56
54
52
50
48
46
44
42
4
ANCE ABOVE MOUTH IN MILES

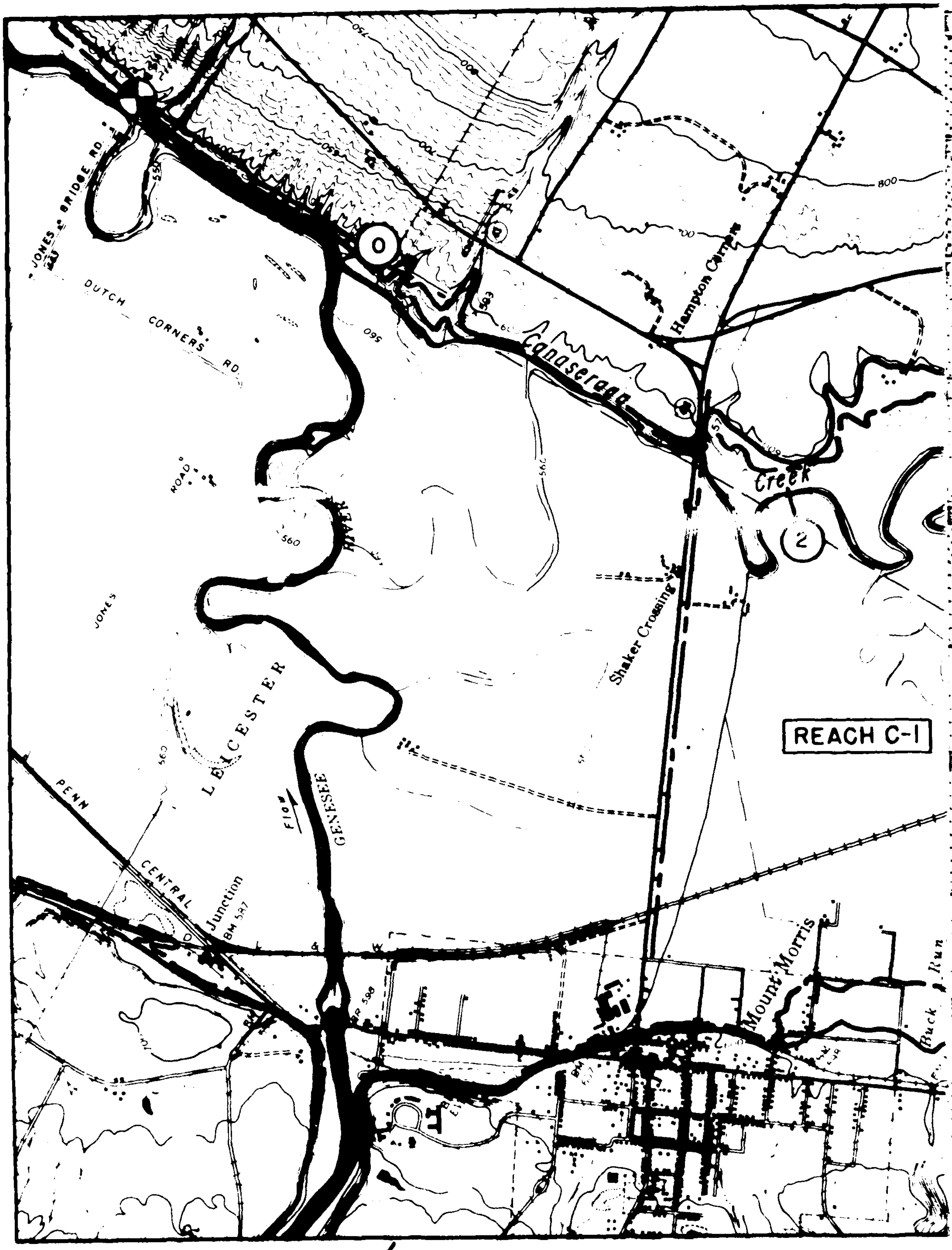


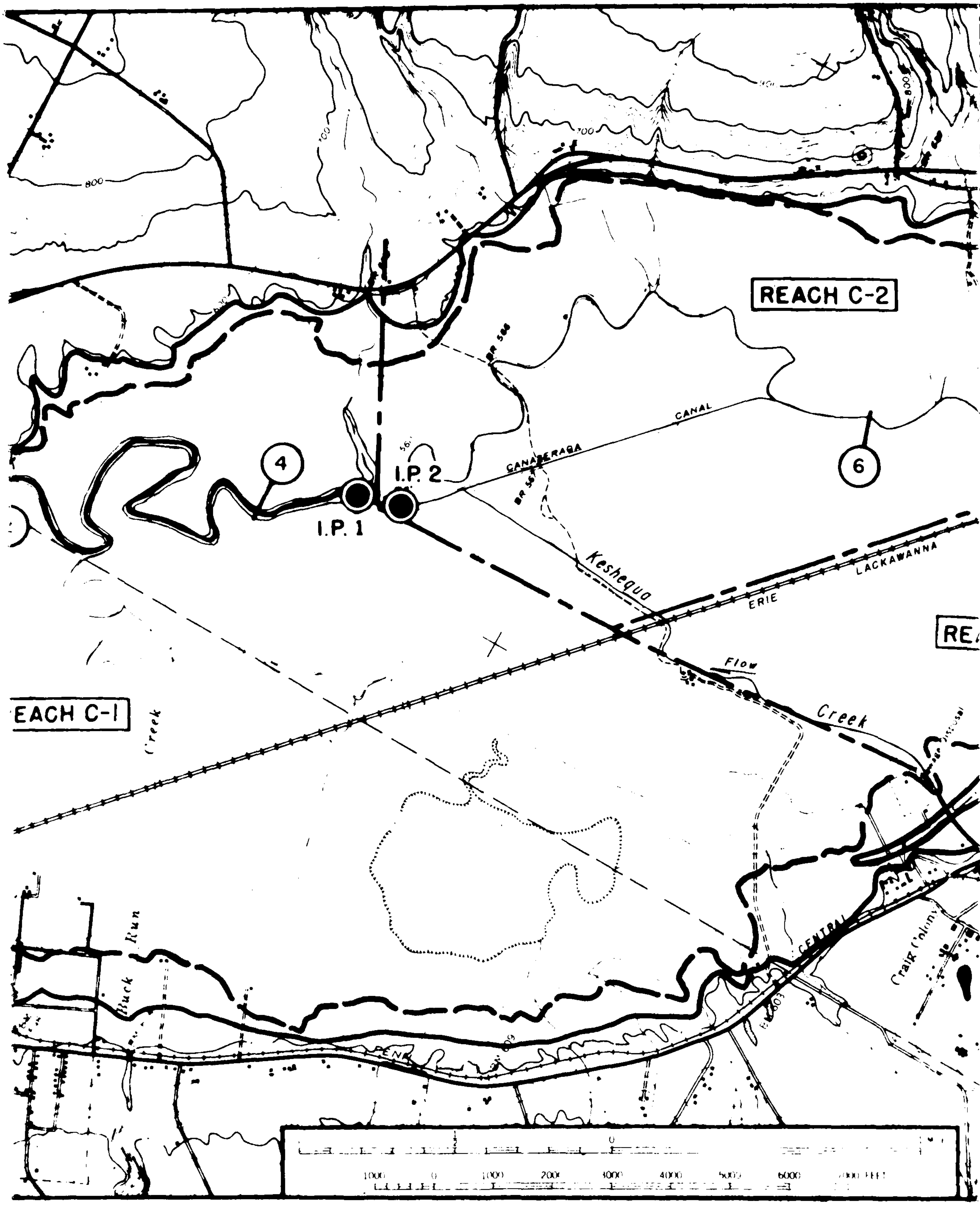
NOTE:
FOR LEGEND SEE PLATE A53

GENESEE RIVER BASIN, NEW YORK

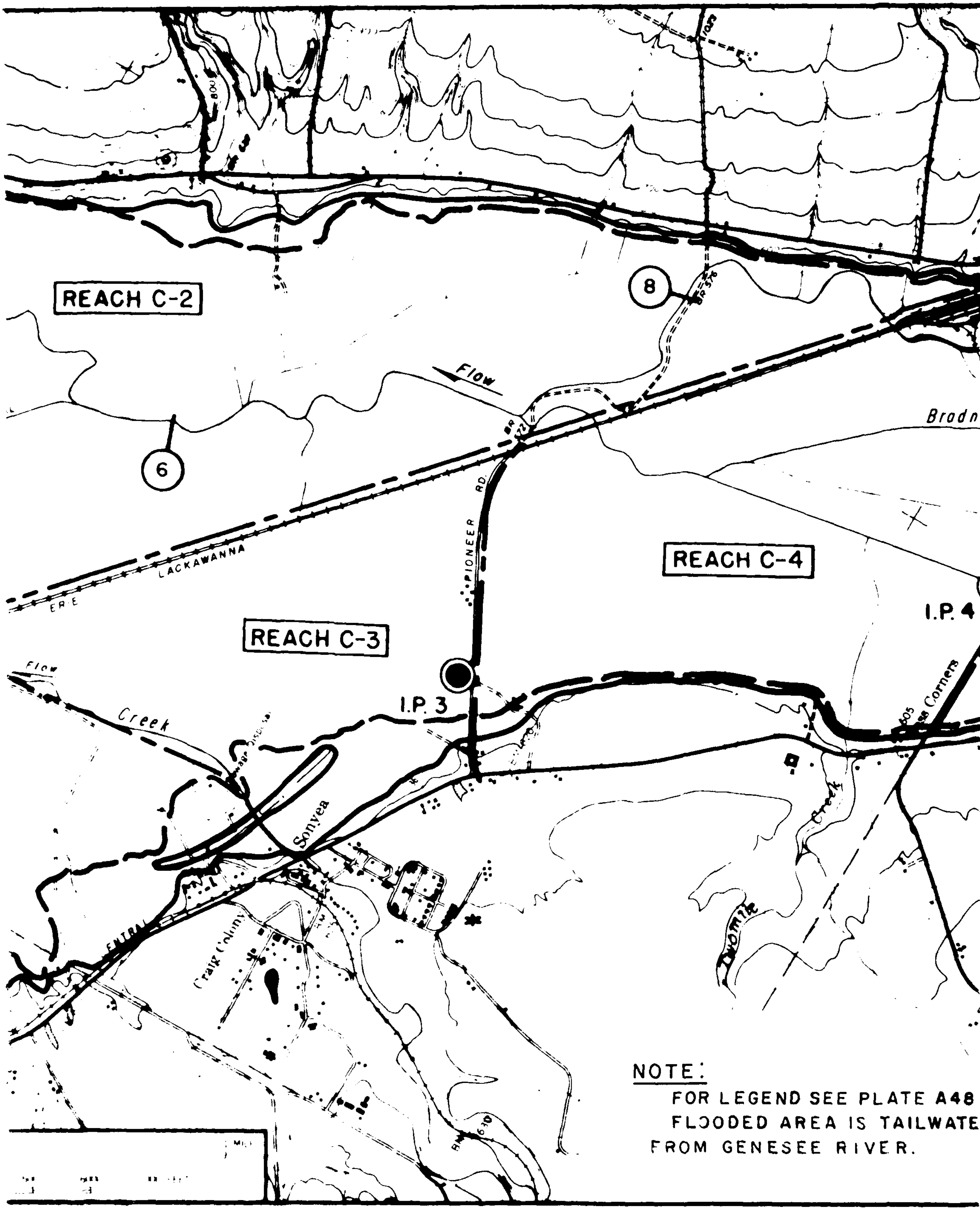
PROFILES
GENESEE RIVER
MILE 36 TO 70

U.S. ARMY ENGINEER DISTRICT, BUFFALO

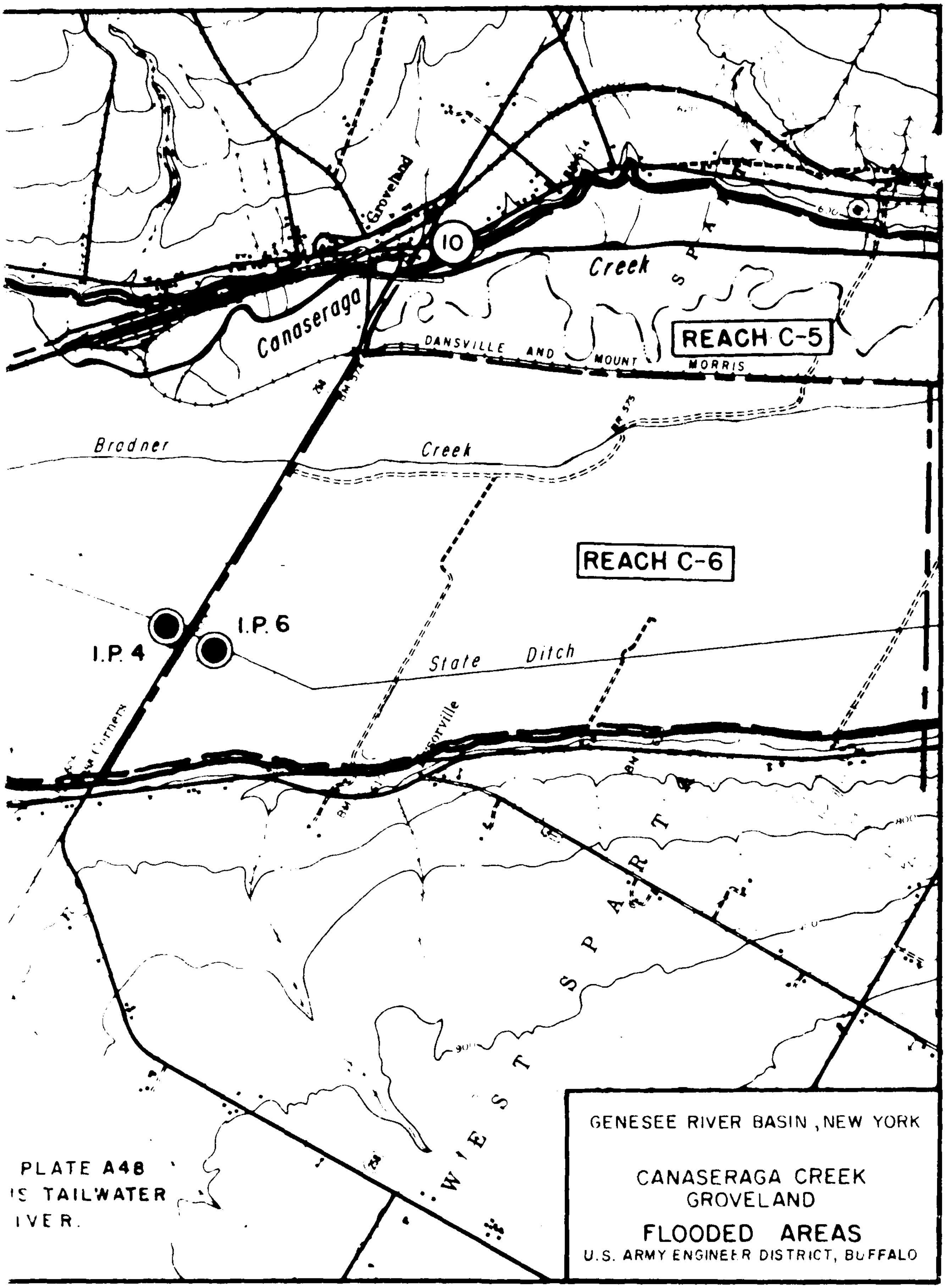

REACH C-1
JONES BRIDGE RD.
DUTCH CORNERS RD.
ROAD
JONES
LEICESTER
GENESEE
FLOW
PENN CENTRAL
Junction
BM 537
Canaseraga
Creek
Hampton Corners
Shaker Crossing
Mount Morris
Buck Run
800
560
0
2


REACH C-2
REACH C-1
RE
4
6
I.P. 1
I.P. 2
CANASERAGA
CANAL
Keshequa
Creek
Flow
ERIE
LACKAWANNA
CENTRAL
Buck Run
Craig Colony
800
700
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

2



REACH C-2
REACH C-3
REACH C-4
8
6
Flow
Flow
Creek
Bradn
PIONEER RD.
ERIE
LACKAWANNA
I.P. 3
I.P. 4
Sonyea
Craig Colony
Creek
NOTE:
FOR LEGEND SEE PLATE A48
FLOODED AREA IS TAILWATE
FROM GENESEE RIVER.



GENESEE RIVER BASIN, NEW YORK

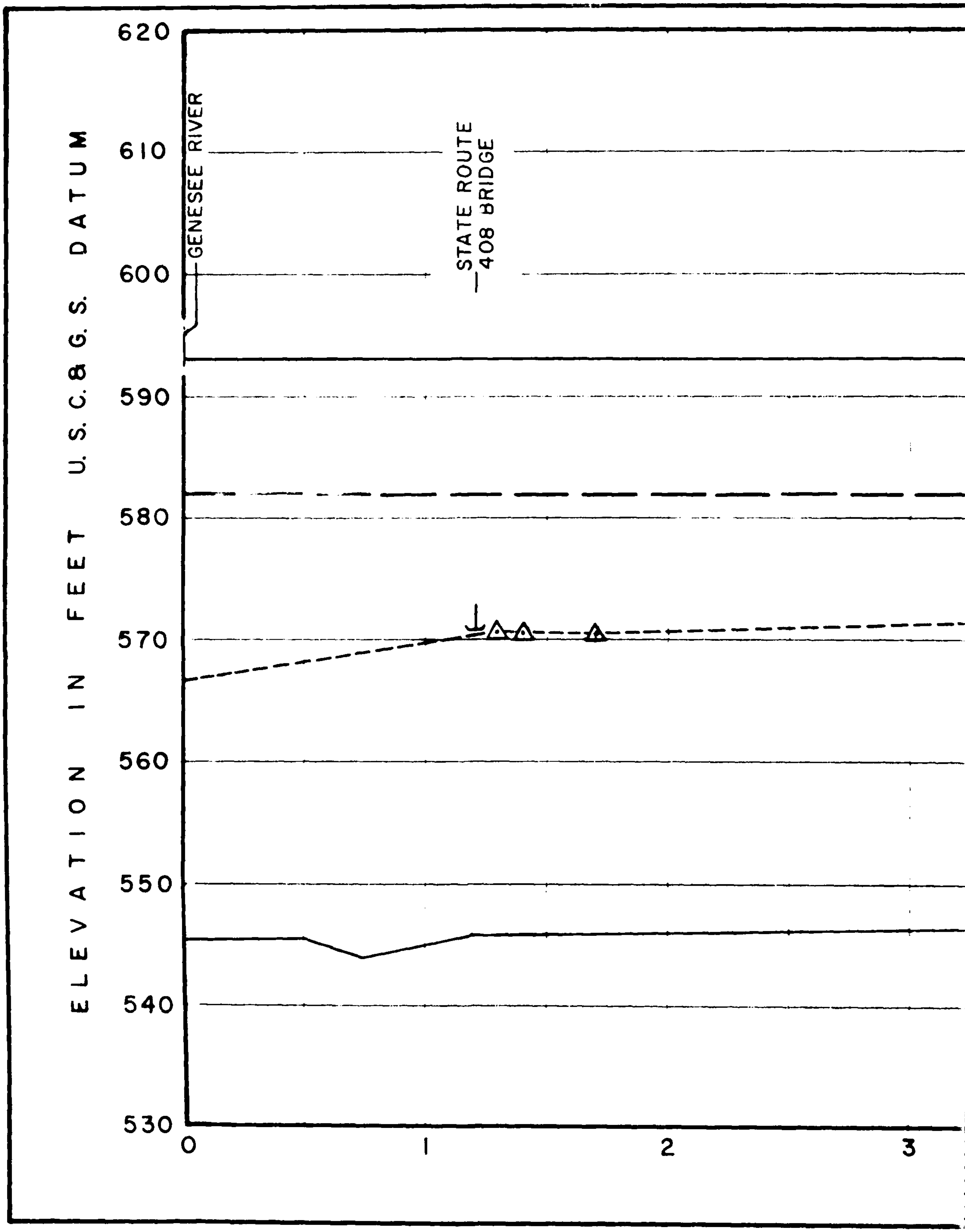
CANASERAGA CREEK
GROVELAND

FLOODED AREAS

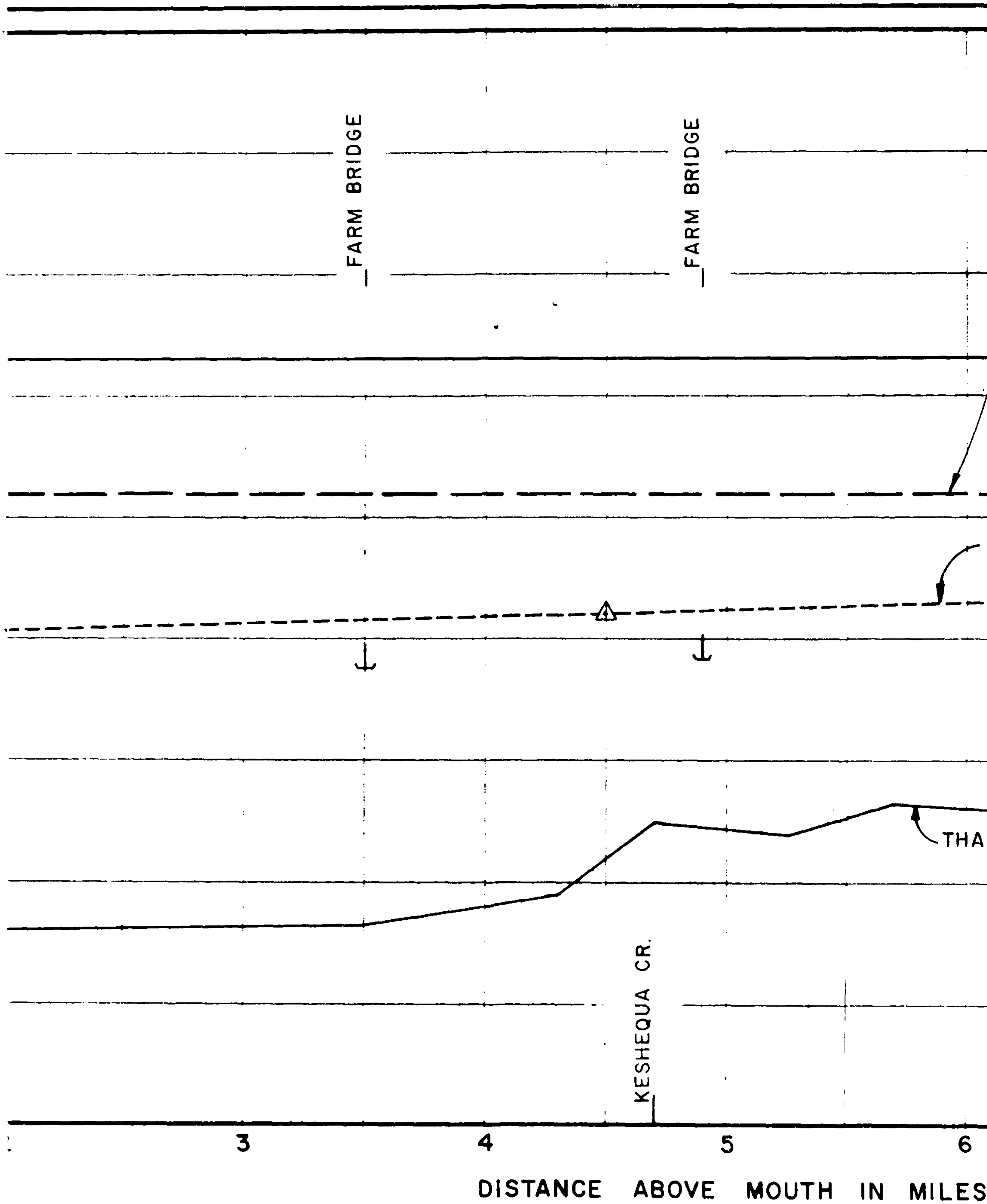
U.S. ARMY ENGINEER DISTRICT, BUFFALO

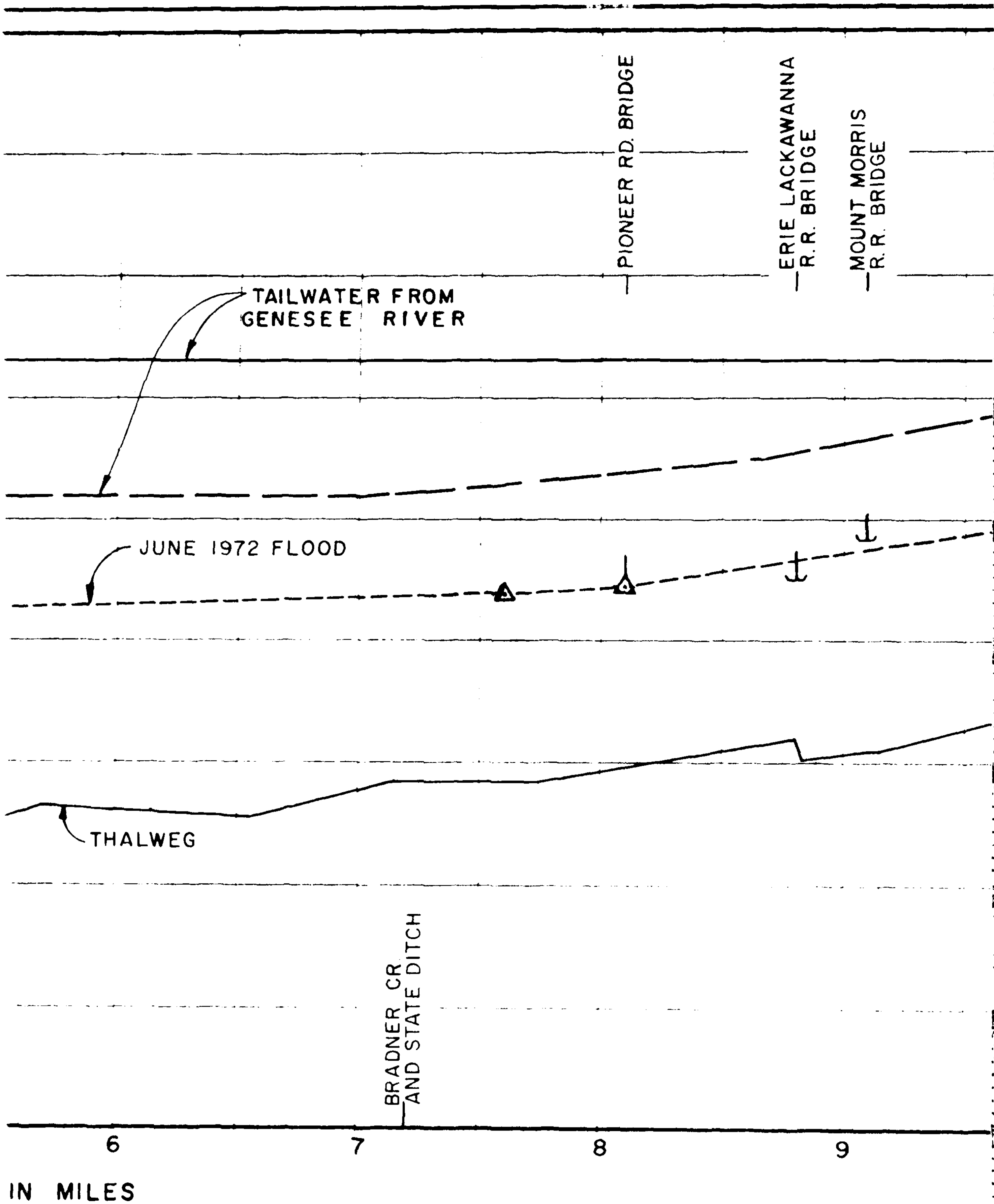
PLATE A55

4

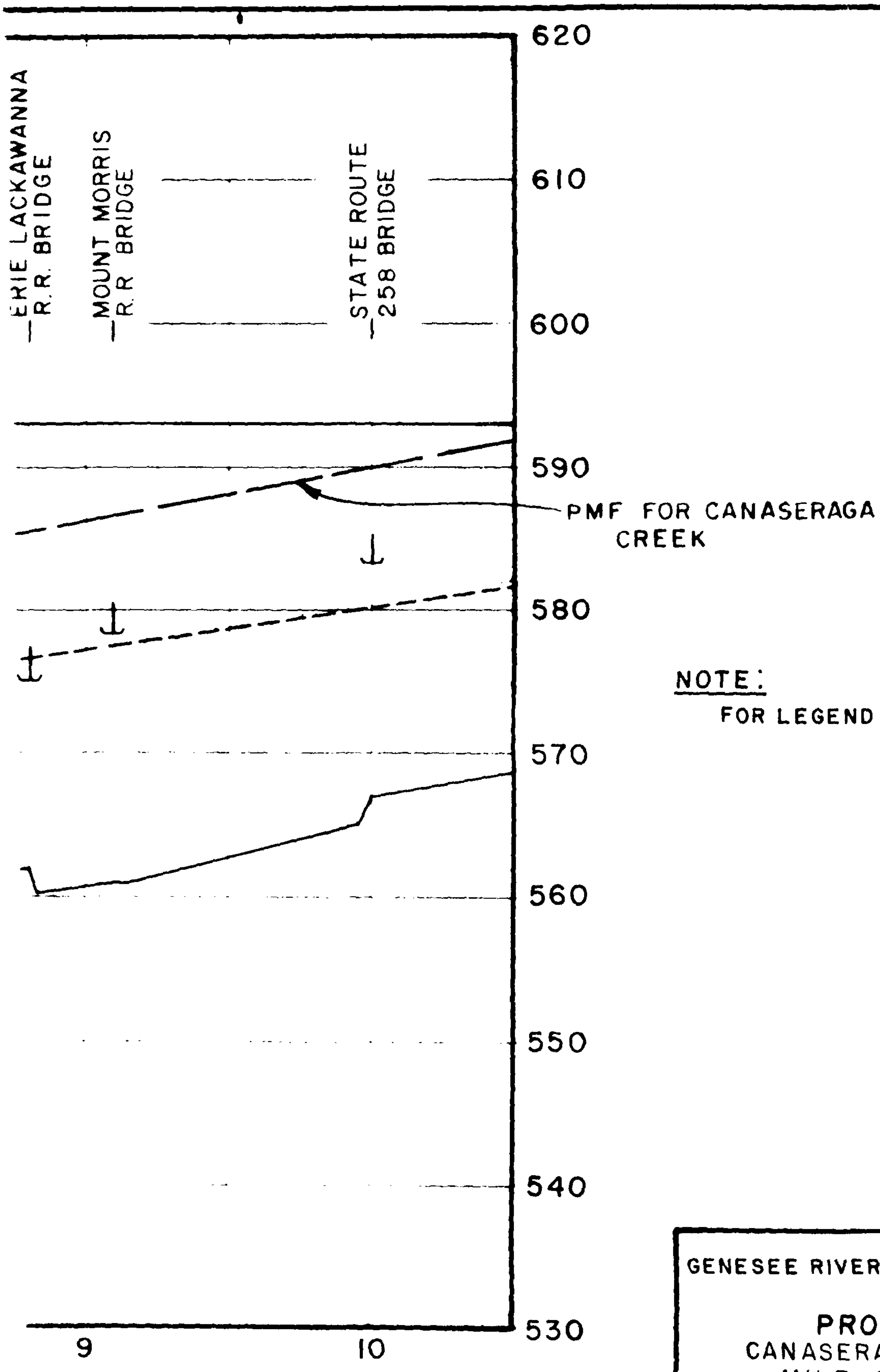

ELEVATION IN FEET U.S.C.&G.S. DATUM
620
610
600
590
580
570
560
550
540
530
GENESEE RIVER
STATE ROUTE 408 BRIDGE
0
1
2
3

/


FARM BRIDGE
FARM BRIDGE
THA
KESHEQUA CR.
3
4
5
6
DISTANCE ABOVE MOUTH IN MILES


PIONEER RD. BRIDGE
ERIE LACKAWANNA R.R. BRIDGE
MOUNT MORRIS R.R. BRIDGE
TAILWATER FROM GENESEE RIVER
JUNE 1972 FLOOD
THALWEG
BRADNER CR. AND STATE DITCH
6
7
8
9
IN MILES

3



NOTE:
FOR LEGEND SEE PLATE A5[illegible]

GENESEE RIVER BASIN, NEW YORK

PROFILES
CANASERAGA CREEK
MILE 0.0 TO 10.5
U.S. ARMY ENGINEER DISTRICT, BUFFALO

PLATE A56

4

END
FILMED
4-86
DTIC